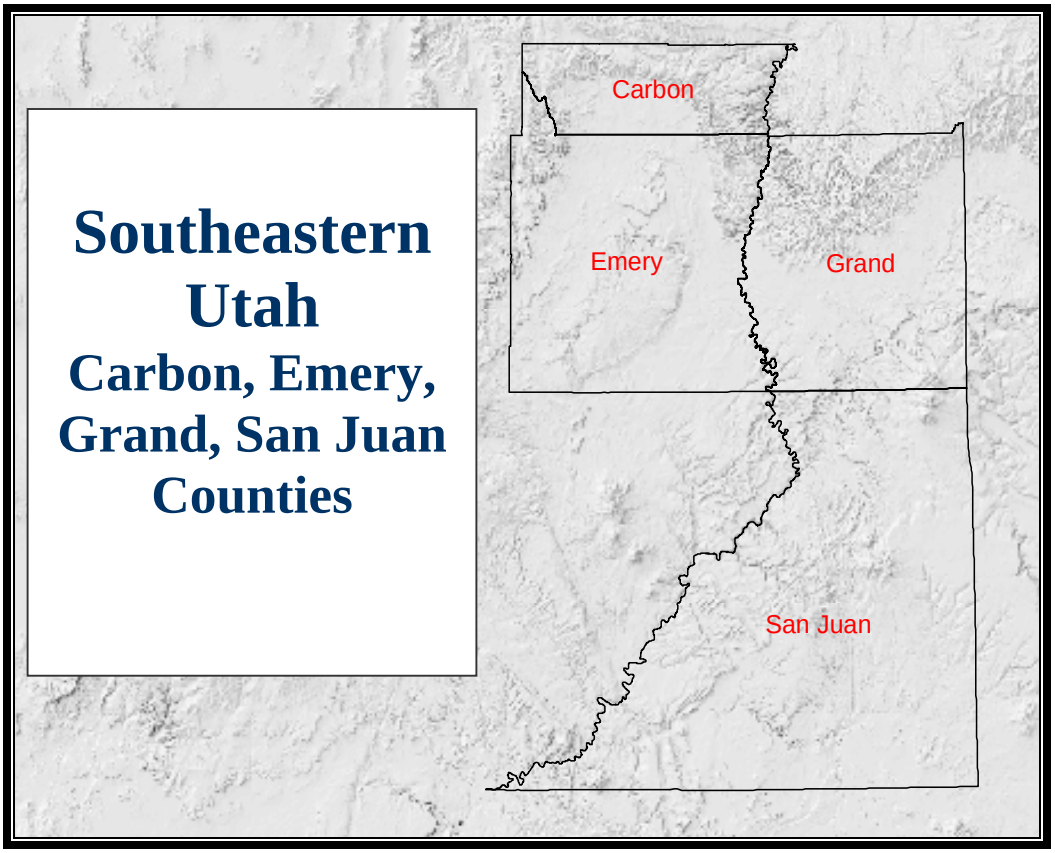
Natural Hazard Pre-Disaster Mitigation Plan



Southeastern Utah

Carbon, Emery, Grand, San Juan Counties

Southeastern Utah Association of Local Governments in association with the Wasatch Front Regional Council

Natural Hazard Pre-Disaster Mitigation Plan

Prepared by LaNiece Dustman with assistance from Jim Boes and Bill Howell, Jeff Adams in the offices of the Wasatch Front Regional Council. Guidance provided by Ryan Pietramali from the Utah Division of Emergency Services and Homeland Security.

December 2003

Executive Summary

Plan Mission
The mission of the Southeastern Utah Association of Local Governments (SEUALG) Pre-Disaster Mitigation Plan (PDM) is to substantially and permanently reduce the region's vulnerability to natural hazards. The plan is intended to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the natural environment. This can be achieved by increasing public awareness, documenting resources for risk reduction and loss-prevention, and identifying activities to guide the community towards the development of a safer more sustainable community.

Plan Organization
The SEUALG plan was developed and organized within the rules and regulations established under CFR Title 44, Part 201.6. The plan contains a discussion on the purpose and methodology used to develop the plan, a profile on communities within SEUALG, as well as a hazard identification study and a vulnerability analysis of eight hazards. To assist in the explanation of the above-identified contents there are several appendices included which provide more detail on specific subjects. This plan is intended to improve the communities within the SEUALG planning district ability to handle disasters, and will document valuable local knowledge on the most efficient and effective ways to reduce loss.

Plan Financing
The SEUALG PDM Plan has been financed and developed under the PDM Program provided by the Federal Emergency Management Agency (FEMA) and the Utah Department of Public Safety Division of Emergency Services and Homeland Security (DESHS). The SEUALG aided in funding by providing in-kind assistance to local governments.

Plan Participation
The SEUALG PDM Plan has been completed as a result of a collaborative effort between The Wasatch Front Regional Council, Southeastern Utah Association of Local Governments, the Utah Department of Public Safety Division of Emergency Services and Homeland Security, City and County Emergency Managers, Fire Departments, Sheriff Departments, Public Works Departments, Planning Commissions, Assessor's Offices, City and County GIS Departments, Elected Officials, Public Employees, and Citizens of the cities and towns within Carbon, Emery, Grand, and San Juan Counties. Interviews were conducted with stakeholders from the communities, and a workshop was conducted during the plan development. Additionally, through public hearings, workshops, and draft plan displays ample opportunity was provided for public participation. Any comments, questions, and discussions resulting from these activities were given strong consideration in the development of this plan.

Hazards Identified
It was suggested by the DESHS that, at minimum, SEUALG address the hazards of: earthquake, flood, landslide, problem soils, wildfire, dam failure, severe weather, and drought. However, there are other hazards that were identified which are not in the minimum criteria established by DESHS that were added to the discussion.

The hazard identification study recognized the following hazards as being the most prevalent and posing the most potential risk to the counties and towns within the SEUALG four county planning districts.

- Dam Failure
- Drought
- Earthquake
- Flood
- Infestation
- Landslide
- Problem Soil

- Severe Weather
- Wildfire

Plan Goals
In an effort to ensure that the mission of the SEUALG PDM Plan is met, the participants in the development of this plan defined and established a list of goals, which are directly relevant to meeting the mission of the plan.

The following is a list of the goals identified by the participants of this plan:

- Protection of life before, during, and after the occurrence of a disaster
- Preventing loss of life and reducing the impact of damage where problems cannot be eliminated
- Protection of emergency response capabilities (critical infrastructure)
- Communication and warning systems
- Emergency medical services and medical facilities
- Mobile resources
- Critical facilities
- Government continuity
- Protection of developed property, homes and businesses, industry, education opportunities and the cultural fabric of a community, by combining hazard loss reduction with the community's environmental, social and economic needs
- Protection of natural resources and the environment, when considering mitigation measures
- Promoting public awareness through education of community hazards and mitigation measures
- Preserving and/or restoring natural features that provide mitigation such as floodplains
- Minimize the impacts of flooding
- Minimize the impacts of drought
- Minimize the impacts of severe weather
- Minimize the risk of wildfire

Acknowledgements

The Southeastern Utah Association of Local Governments in conjunction with the Wasatch Front Regional Council would like to thank the employees of each jurisdiction in the SEUALG region. We would also like to extend our appreciation to the following agencies, which assisted in the development of this plan.

- Utah Division of Emergency Services and Homeland Security
- Federal Emergency Management Agency
- National Weather Service
- National Climate Data Center
- Utah Army Corps of Engineers
- Utah Geologic Survey
- Utah Division of Forestry Fire, and State Lands
- Division of Water Rights Dam Safety Section
- Utah Division of Water Resources
- Utah Department of Agriculture
- Utah Avalanche Center
- Utah Automated Geographic Resource Center
- University of Utah
- University of Utah Seismic Station
- Utah State University
- Councils of Governments
- Association of Governments
- Carbon County and municipalities including East Carbon City, City of Helper, Price City, Scofield Town, Sunnyside City, and Wellington City
- Carbon County elected officials and planners
- Carbon County GIS staff member Benjamin Clement
- Carbon County residents and other interested members
- Carbon County agencies including; public works, GIS office, assessors office, LEPC, emergency services division, fire and sheriff's office
- Emery County and municipalities including Castle Dale City, Clawson Town, Cleveland Town, Elmo Town, Emery Town, Ferron City, Green River City, Huntington City, and Orangeville City
- Emery County emergency manager Martin Wilson
- Emery County elected officials
- Emery County agencies including; GIS department, public works, and assessors office
- Emery County residents and other interested members of the public
- Grand County and municipalities including Castle Valley and Moab City
- Grand County emergency manager Mary Hofine
- Grand County elected officials
- Grand County agencies including engineering, planning, assessors office, GIS department
- Grand County public and other interested members
- San Juan County and municipalities Monticello and Blanding
- San Juan County emergency manager Rick Bailey
- San Juan County elected officials
- San Juan County agencies including GIS, engineers, planners, assessors
- San Juan County public and interested members
- In addition, we offer sincere thanks to the Town of Merrimack, Clackamas County, Dunkerton, Iowa, Dunn County North Dakota, Jefferson County West Virginia, Moab City, and Salt Lake City.

Table of Contents

Part 1. Introduction

The State of Utah is vulnerable to natural, technological, and man-made hazards that have the possibility of causing serious threat to the health, welfare, and security of our citizens. The cost of response to and recovery from potential disasters can be substantially reduced when attention is turned to mitigating their impacts and effects before they occur or re-occur.

Hazard mitigation is defined as any cost-effective action that has the effect of reducing, limiting, or preventing vulnerability of people, property, and/or the environment to potentially damaging, harmful, or costly hazards. Hazard mitigation actions, which can be used to eliminate or minimize the risk to life and property, fall into three categories: first, those that keeps the hazard away from people, property, and structures: second, those that keeps people, property, and structures away from the hazard: and third, those that do not address the hazard at all but rather reduce the impact of the hazard on the victims such as insurance. This mitigation plan has strategies that fall into all three categories.

Hazard mitigation actions must be practical, cost effective, environmentally, and politically acceptable. Actions taken to limit the vulnerability of society to hazards must not in themselves be more costly than the value of anticipated damages.

Capital investment decisions must be considered in conjunction with natural hazard vulnerability. Capital investments can include; homes, roads, public utilities, pipelines, power plants, chemical plants, warehouses, and public works. These decisions can influence the degree of hazard vulnerability of a community. Once a capital facility is in place very few opportunities will present themselves over the useful life of the facility to correct any errors in location or construction with respect to hazard vulnerability. It is for these reasons that zoning ordinances, which restrict development in high vulnerability areas, and building codes, which ensure that new buildings are built to withstand the damaging forces of hazards, are the most useful mitigation approaches a city can implement.

In the past, mitigation has been the most neglected aspect within emergency management. Since the priority to implement mitigation activities is generally low in comparison to the perceived threat, some important mitigation measures are neglected in favor of high-profile events. Mitigation success can be achieved, however, if accurate information is portrayed through complete hazard identification and impact studies, followed by effective mitigation management. Hazard mitigation is the key to greatly reducing long-term risk to people and property living in Utah from natural hazards and their effects. Preparedness for all hazards includes response and recovery plans, training, development, management of resources, and the need to mitigate each jurisdictional hazard.

A. Purpose

The purposes of this plan are as follows: to fulfill federal, state, and local hazard mitigation planning obligations; to engage in long-term mitigation planning, and to direct mitigation actions which would serve to minimize conditions which would have an undesirable impact on our citizens, the economy, environment, and the well-being of the state of Utah. This plan enhances the awareness of city and county officials, agencies, and the public to the threat that hazards have on property and life and what can be done to help prevent or reduce the vulnerability of each Utah jurisdiction.

B. Scope

The SEUALG PDM plan was developed in accordance with the requirements of the FEMA Section 322 regulations, DESHS, local planning agencies, the Southeastern Utah Association of Local Governments, and the Wasatch Front Regional Council.

The goal of this plan is to assist the area consisting of the Carbon, Emery, Grand, and San Juan counties in reducing their costs of natural disasters through mitigation practices. This plan provides comprehensive hazard identification, risk assessment, vulnerability analysis, mitigation actions, and an implementation schedule for the region.

Regulations set forth by FEMA in were followed during development of this plan. Future monitoring, evaluating, updating and implementation will take place as new incidents occur or every five years.

C. Authority

Federal: Public Law 93-288 as amended, established the basis for federal hazard mitigation activity in 1974. A section of this Act requires the identification, evaluation, and mitigation of hazards as a prerequisite for state receipt of future disaster assistance outlays. Since 1974, many additional programs, regulations, and laws have expanded on the original legislation to establish hazard mitigation as a priority at all levels of government. When PL 93-288 was amended by the Stafford Act, several additional provisions were also added that provide for the availability of significant mitigation measures in the aftermath of Presidential declared disasters. Civil Preparedness Guide 1-3, Chapter 6- Hazard Mitigation Assistance Programs places emphasis on hazard mitigation planning directed toward hazards with a high impact and threat potential.

President Clinton signed the Disaster Mitigation Act of 2000 (DMA 2000) into Law on October 30, 2000. Section 322, defines mitigation planning requirements for state, local, and tribal governments. Under Section 322 States are eligible for an increase in the Federal share of hazard mitigation, if they submit a mitigation plan (which is a summary of local and/or regional mitigation plans) that identifies natural hazards, risks, vulnerabilities, and which describes proposed actions to mitigate the hazards risks and vulnerabilities in that plan.

State: The Governor's Emergency Operation Directive, The Robert T. Stafford Disaster Relief and Emergency Assistance Act, amendments to Public Law 93-288, as amended, Title 44, CFR, Federal Emergency Management Agency Regulations, as amended, State Emergency Management Act of 1981, Utah Code 53-2, 63-5, Disaster Response Recovery Act, 63-5A, Executive Order of the Governor, Executive Order 11, Emergency Interim Succession Act, 63-5B.

Local: Local governments play an essential role in implementing effective mitigation. Each local government will review all present or potential damages, losses, and related impacts associated with natural hazards to determine the need or requirement for mitigation action and planning. In the counties and cities making up the SEUALG, the local executive responsible for carrying out plans and policies are the county Commissioners and city or town Mayors. Local governments must be prepared to participate in the post disaster Hazard Mitigation Team process and the pre-mitigation planning as outlined in this document.

Association of Governments: The Association of Governments have been duly constituted under the authority of Title XI, Chapter 13, Utah Code Annotated, 1953, as amended (The Inter-local Cooperation Act); and pursuant to Section 3 of the Executive Order of the Governor of the State of Utah, dated May 27, 1970, with the authority to conduct planning studies and to provide services to its constituent jurisdictions.

D. Goals and Objectives

The goals and objectives of the PDM plan included coordination with local governments to develop a regional planning process meeting each plan component identified in the FEMA Region VIII Crosswalk document, DESHS planning expectation, and local input. And meet the need of reducing risk from natural hazards in Utah, through the implementation of and updating of regional plans.

Local Goals: These goals form the basis for the development of the PDM Plan and are shown from highest priority, at the top of the list, to those of lesser importance nearer the bottom.

- Protection of life before, during, and after the occurrence of a disaster
- Preventing loss of life and reducing the impact of damage where problems cannot be eliminated
- Protection of emergency response capabilities (critical infrastructure)
- Communication and warning systems
- Emergency medical services and medical facilities
- Mobile resources
- Critical facilities
- Government continuity
- Protection of developed property, homes and businesses, industry, education opportunities and the cultural fabric of a community, by combining hazard loss reduction with the community's environmental, social and economic needs
- Protection of natural resources and the environment, when considering mitigation measures
- Promoting public awareness through education of community hazards and mitigation measures
- Preserving and/or restoring natural features that provide mitigation such as floodplains

Long Term Goals:

- Eliminate or reduce the long-term risk to human life and property from identified natural and technologic hazards
- Aid both the private and public sectors in understanding the risks they may be exposed to and finding mitigation strategies to reduce those risks
- Avoid risk of exposure to identified hazards
- Minimize the impacts of those risks when they can not be avoided
- Mitigate the impacts of damage as a result or identified hazards
- Accomplish mitigation strategies in such away that negative environmental impacts are minimized
- Provide a basis for funding of projects outlined as hazard mitigation strategies
- Establish a regional platform to enable the community to take advantage of shared goals, resources, and the availability of outside resources

Objectives: The following objectives are meant to serve as a measure upon which individual hazard mitigation projects can be evaluated. These criteria become especially important when two or more projects are competing for limited resources.

- Identification of persons, agency or organization responsible for implementation
- Projecting a time frame for implementation
- Explanation of how the project will be financed including the conditions for financing and implementing as information is available
- Identifying alternative measures, should financing not be available
- Be consistent with, support, and help implement the goals and objectives or hazard mitigation plans already in place for surrounding counties
- Have significant potential to reduce damages to public and/or private property and/or reduce the cost of, state, and federal recovery for future disasters
- Be the most practical, cost-effective, and environmentally sound alternative after consideration of the options

- Address a repetitive problem, or one that has the potential to have a major impact on an area, reducing the potential for loss of life, loss of essential services and personal
- Property, damage to critical facilities, economic loss, and hardship or human suffering
- Meet applicable permit requirements
- Not encourage development in hazardous areas
- Contribute to both the short and long term solutions to the hazard vulnerability risk problem
- Assuring the benefits of a mitigation measure is equal to or exceeds the cost of implementation
- Have manageable maintenance and modification costs
- When possible, be designed to accomplish multiple objectives including improvement of life-safety risk, damage reduction, restoration of essential services, protection or critical facilities, security or economic development, recovery, and environmental enhancement
- Whenever possible, use existing resources, agencies and programs to implement the project

Part 2. Adoption Process and Documentation

The SEUALG PDM plan was developed as a multi-jurisdictional plan; therefore, to meet the requirements of Section 322 of the local hazard planning regulations the final plan was to be adopted by each of the municipalities as well as the four counties. This section documents the adoption process of each local government in order to demonstrate compliance with this requirement. The plan was adopted prior to being submitted to FEMA region VIII for final review. Table 2-1 identifies the communities that participated in the planning process and have adopted the plan. The following is a sample of the Adoption Resolutions.

Table 2-1 Participating Communities

Counties	Participated (Yes/ No)	Date
Carbon County		
East Carbon City		
City of Helper		
Price City		
Scofield Town		
Sunnyside City		
Wellington City		
Emery County		
Castle Dale City		
Clawson Town		
Cleveland Town		
Elmo Town		
Emery Town		
Ferron City		
Green River City		
Huntington City		
Orangeville City		
Grand County		
Castle Valley		
Moab City		
San Juan County		
Monticello City		
Blanding City		

RESOLUTION NO._____

A RESOLUTION ADOPTING THE SOUTHEASTERN UTAH ASSOCIATION OF LOCAL GOVERNMENTS (SEUALG) NATURAL HAZARD PRE-DISASTER MITIGATION PLAN AS REQUIRED BY THE FEDERAL DISASTER MITIGATION AND COST REDUCTION ACT OF 2000.

WHEREAS, President William J. Clinton signed H.R. 707, the Disaster Mitigation and Cost Reduction Act of 2000, into law on October 30, 2000.

WHEREAS, the Disaster Mitigation Act of 2000 requires all jurisdictions to be covered by a Pre-Disaster Hazard Mitigation Plan to be eligible for Federal Emergency Management Agency post-disaster funds,

WHEREAS, Southeastern Utah Association of Local Governments has been contracted by the State of Utah to prepare a Pre-Disaster Mitigation Plan covering all of the jurisdictions in the SEUALG area, and

WHEREAS, the WFRC Executive Council approved WFRC staff to write the plan on February 21, 2002, and

WHEREAS, XXX City is within the SEUALG Area, and

WHEREAS, the XXX City Council is concerned about mitigating potential losses from natural hazards/ disasters before they occur, and

WHEREAS, the plan identifies potential hazards, potential losses and potential mitigation measures to limit losses, and

WHEREAS, the XXX City Council has determined that it would be in the best interest of the community as a whole to adopt the Natural Hazard Pre-Disaster Mitigation Plan as it pertains to the City, therefore

BE IT RESOLVED BY THE XXX CITY COUNCIL THAT:

The attached "Southeastern Utah Association of Local Governments Natural Hazard Pre-Disaster Mitigation Plan" be adopted to meet the requirements of the Disaster Mitigation and Cost Reduction Act of 2000.

This resolution shall be effective on the date it is adopted.

DATED this _____ day of _____, 2003.

_____
Mayor
XXX City

ATTEST:

_____
Recorder

Part 3. Planning Process

This plan was prepared in the offices of the Wasatch Front Regional Council (WFRC) by appointed staff members Lane Nielson, LaNiece Dustman, and Jim Boes, and was supported by the local planning team members Bill Howell, and Jeff Adams of SEUALG. Input from the following agencies was critical in completing this plan: city and county emergency managers, fire departments, sheriff departments, public works departments, planning commissions, assessor's offices, city and county GIS departments, elected officials, public employees, and citizens of the cities and towns within Carbon, Emery, Grand, and San Juan Counties. The planning process was based on Section 322 requirements of the Disaster Mitigation Act of 2000 (DMA 2000) and supporting guidance documents developed by FEMA and the Utah DESHS.

The planning process included the following steps:

1. Resource Organization
2. Public Officials Outreach
3. Establish Continuity in Planning Process
4. Data Acquisition
5. Hazard Risk Identification and Analysis
6. County Vulnerability Assessment
7. Community Goals Assessment
8. Formation of County Mitigation Steering Committee
9. Mitigation Strategy Development
10. Prioritization of Identified Mitigation Strategies
11. State Plan Review
12. Adoption

Step 1: Resource Organization

The seven regional Associations of Government (AOG) were recommended to conduct the planning efforts by the Utah League of Cities and Towns and the Governors office of Planning and Budget to ensure coordination with elected officials, emergency managers, planners, public works departments, and information technology specialists. Utah DESHS contracted with the seven AOG's as sub-grantees to coordinate, develop, and write the seven regional hazard mitigation plans under planning guidelines included in the DMA 2000.

SEUALG contracted with WFRC to conduct the planning for its four county region based on WFRC's technical capabilities. For coordination, WFRC has assigned a staff member to act as a SEUALG liaison. The two associations have worked closely together to ensure local coordination and input.

WFRC and SEUALG designated a core planning team. The core planning team, see Table 3-1, was the main agent of the planning process from the initiation of the plan to the development and coordination to the resolution of the plan's adoption. In conjunction with the core planning team a technical team committee was created (Table 3-2). Local committees were established to provide a central point of contract with each county see Table 3-3. These local communities were instrumental in providing detailed knowledge of there county, political make, capabilities, and above all both hazard and area specific mitigation.

Table 3-1 Core Planning Team

Name	Organization/Title
Lane Nielson	Wasatch Front Regional Council, Community Development and Planner
LaNiece Dustman	Wasatch Front Regional Council, Hazard Mitigation Planner
Bill Howell	Southeastern Utah Association of Local Governments, Executive Director
Jeff Adams	Southeastern Utah Association of Local Governments, Community Planner Director
Jim Boes	Wasatch Front Regional Council, Planner
Ryan Pietramali	State Natural Hazard Mitigation Planner

Table 3-2 Technical Team Committee

Name	Organization
Ryan Pietramali	Utah Division of Emergency Services and Homeland Security
Lane Nielson	Wasatch Front Regional Council
LaNiece Dustman	Wasatch Front Regional Council
Jeff Adams	Southeastern Utah Association of Local Governments
Jim Boes	Wasatch Front Regional Council
Jeff Gilbert	Bear River Association of Governments
Ken Sizemore	Five County Association of Governments
Curt Hutchings	Five County Association of Governments
Andrew Jackson	Mountainland Association of Governments
Emery Polelonema	Six County Association of Governments
Edwin Benson	Six County Association of Governments
Yankton Johnson	Uintah Basin Association of Governments

Table 3-3 Local Planning Team

Carbon County	**Organization**
Clyde Larsen	Chairman
Gary Sontag	Price City
Nick Tatton	Price City
Guy Norton	Price City Fire Department
Ray Labauhn	Carbon Power Plant
Dan Reevley	Price City Council
Ben Clement	Carbon County GIS
Emery County	
Martin Wilson	LEPC Chair/County Sheriff
Terrie C. Wright	Emery Preparedness Planner/Coordinator
Diane Chandler	EMT/Green River City
Kyle Ekker	Deputy Emery Co. Sheriff's Dept.
J.J. Grant	Emery Co. School District
Judy Lang	Emery Co. Sheriff's Dept.
Dennis Dooley	Co. Dir./LEPC Chair
John Rokich	Dept. of Emergency Safety
Carey Bloomer	Clawson City Mayor
W. Brent Langston	Emery Co. Attorney's Office
Dave Warner	Road Department
Brent Williams	Public Works

Dale Pierson	Water/Sewer Supervisor
Grand County	
Jim Nyland	Grand County Sheriff
Mike NaVarre	Moab City Police Dept.
Corky Brewster	Moab Valley Fire Chief
Judy Bane	Grand County Administrator
Dave Sakrison	Mayor of Moab City
Donna Messler	City Administrator
Jim Lewis	County Council
Dave Warner	Road Department
Brent Williams	Public Works
Dale Pierson	Water/Sewer Supervisor
San Juan County	
Rick Bailey	County Administrator
Tammy Gallegos	County IT Specialist
Bret Hosler	Blanding planner
Greg Martin	Monticello Planner/Assistant City administrator
Patrick McDermott	Bluff Town Council

Step 2: Public Officials Outreach
To ensure the planning process had backing from the elected officials, a representative from SEUALG met with each County Commission and each city mayor to inform them of the need for the plan and how it can better help the communities. With local support in place, the intent of the plan was introduced to commissioners and other elected officials along with public entities through an informational brochure that was created by the WFRC.

Step 3: Establish Continuity in the Planning Process
To meet the requirements set forth by DMA 2000, the seven AOG's were contracted by the DESHS to assist all counties within Utah in completing the seven multi-regional PDM plans. The seven AOG's formed a Technical Team Planning Committee to share ideas and ensure the plans were similar and that there was little duplication of effort. Planners from the SEUALG were involved with this committee (Table 2).

Step 4: Data Acquisition
Contact was made with the GIS technician or planning commission in each city and county to assess what data was available on a local level. Agreements were put in place to allow the exchange of data between the local jurisdictions, SEUALG, and WFRC. Data layers obtained included some or all of the following: local roads, plot maps, county tax assessor's data, hazard data, flood maps, topographic data, aerial photographs, and land development data. This step also included a survey sent to each jurisdiction to ascertain what hazards each jurisdiction felt they were vulnerable to, what natural disaster had occurred, and what mitigation plans and ordinances are in place.

Step 5: Hazard Risk Identification and Analysis
These steps were conducted by gathering data on the hazards that occurred within the planning region. This information was gathered from local, state, and federal agencies and organizations, as well as, from newspaper and other local media accounts, state and local weather records, conversations with the public and local officials, surveys, interviews, and meetings with key informants within the planning area. Mitigation planning meetings were held during this process and are explained in further detail in Table 3-4. During these meetings attendees had the opportunity to review the general information on previous hazards and comment on them in a more specific manner. These meetings also provided a forum for discussion on the background information that was needed to gain a general understanding of the geography, geology, recreation, natural resources, and water resources of the planning region. These initial contacts with local entities also provided visual understanding of the planning region for planners of the core planning team.

Step 6: County Vulnerability Assessment
This step was conducted through a review of local base maps, topographical maps, floodplain maps, USGS and UGS maps, AGRC maps, FEMA hazard maps, and county hazard maps. A detailed vulnerability assessment was completed with the use of GIS software for each county within the SEUALG planning region. HAZUS MH was used to determine vulnerability to earthquakes, floods, landslides, and wildfire. Loss estimation methodology was developed by the core planning team, with assistance from the technical team, to determine vulnerability from each identified hazard. When available county parcel data was used to estimate the number of residents that could be affected by the hazard. If county parcel data was unavailable then Census 2000 block data was used. During these meetings attendees had the opportunity to review the specific information generated by GIS products and to review areas of vulnerability in association with specific hazards.

Step 7: Community Goals Assessment
This step was conducted through a review of the governing documents of the planning region, as well as, conversations, interviews, and meetings with interested community members. This step identified what goals are already established and adopted for the planning area and whether or not they promote or deter mitigation activities.

Step 8: Formation of County Mitigation Steering Committee
Carbon County (in conjunction with Price City), Emery County, Grand County and San Juan County all set up mitigation planning steering committees. These committees were formed of individuals with an interest in mitigation and public employees with technical expertise pertinent to mitigation. These committees included elected officials, city planners, city engineers, county and city GIS staff, floodplain managers, and emergency managers. Committee members were tasked with completing the Mitigation Strategies Workbook issued by the DESHS.

Step 9: Mitigation Strategy Development
Developing the mitigation strategies was a process in which all of the previous steps were taken into account. Each County that participated in the County PDM Planning Grant was asked to evaluate the vulnerability assessment completed by SEUALG and complete a Mitigation Strategies Workbook (Appendix F).

A County PDM Mitigation Strategies Workbook team was formed consisting of the local planning team members identified in Table 3. Mitigation strategies were determined on a community and countywide level. To obtain a better understanding of the risks that each jurisdiction and/or county faces, each participant reviewed maps created by WFRC and local GIS specialists that profiled hazards and vulnerability assessments.

Step 10: Prioritization of Identified Mitigation Strategies
The DMA 2000 requires state, tribal, and local governments to show how mitigation actions were evaluated and prioritized. This was completed by the AOG with assistance from each county and city. Prioritization was done using the STAPLEE method explained in the FEMA How to Guide, 386-3.

Step 11: State Review
The DESHS pulled together a formal PDM plan review committee to insure local plans met the requirements of DMA 2000. This committee reviewed the plans from October 15 through November 1, 2003 and again from January 1 to January 15, 2004 subsequent to submission to FEMA for final review and acceptance.

Step 12: Adoption
The plan went through a public hearing process on (date) and was adopted by: (insert names of all counties, towns and cities).

Table 3-4 Southeastern Utah Association of Local Governments Pre-Disaster Mitigation Planning Process Timeline

Date	Activity	Purpose
March 29, 2002	Letter of Intent that identifies the seven Association of Governments as sub-grantees of the state to write the PDM plans. The AOG's were chosen by the Utah Interagency Technical Team who is part of Nature-Safe Utah (Utah's Pre-Disaster Mitigation Program).	Continue the relationship with local council members and municipalities.
May 15-16, 2002	Utah's first regional mitigation planning training piloted toward the seven AOG's	Establish a guideline and timeframe.
July 12,2002	News Release from Governor Michael Leavitt announcing the new program to develop local hazard mitigation plans statewide.	Conduct public awareness and involvement.
August, 2002	Gather information.	Data Collection.
September 10, 2002	Meeting. Met with all AOG's and DESHS to discuss the planning process.	Identify planning team and available resources.
September 30, 2002	Public Meeting. Met with Emergency Managers in the Southeastern region.	Identify level of involvement.
October 31, 2002	Meeting. Met with DESHS.	Discuss timeline and planning process.
November 2002	Gathered community data for regional data section of the plan.	Data Collection.
November 18, 2002	Public Meeting. Carbon County meeting with local and state DESHS, city and county officials including Helper City Fire Department, Wellington community member, Price City Emergency Preparation Committee, Carbon County emergency manager.	Kick off meeting. Handed out questionnaires and brochures for local comment and awareness.
November 18, 2002	Public Meeting. Emery County meeting with public safety officials from Orangeville City, Building Inspector from Huntington City, Emery City, Clawson City, Cleveland City, Elmo City and Ferron City mayor's. Sheriff and Road Department from Emery County, Castle Dale city planning and zoning, Huntington City and Green River City local community members.	Kick off meeting. Handed out questionnaires and brochures for local comment and awareness.
November 22, 2002	Meeting. Met with technical team members.	Solicit public involvement, Army Corps proposal for flood study, GIS training, timeline, review the regional plans
December, 2002	Gathering data.	Data Collection
January, 2003	Gathering data.	Data Collection.
January 22, 2003	Public Meeting. AOG executive director's meeting.	Signed contracts for Army Corps flood proposal.
February 13, 2003	Public Meeting. Grand County (in Moab City). Local community member	Kick off meeting. Handed out questionnaires and brochures for local

	meeting. GIS staff, geologist, planning commission, hydrologist, state DESHS, AOG's staff members all attended the meeting.	comment and awareness.
February 13, 2003	Public Meeting. San Juan County community member meeting. Met with GIS staff, state DESHS, local AOG members, and county emergency manager.	Kick off meeting. Handed out questionnaires and brochures for local comment and awareness.
February 27, 2003	Meeting. Met with technical team members in St. George.	Review of plans, mapping.
March, 2003	Information gathering	Data Collection, plan
April 21, 2003	Meeting. AOG executive director's meeting.	PDM extension and additional money.
April, 2003	Drafting of the plan.	For review.
May 16, 2003	Meeting. AOG executive directors meeting.	Discussion of progress; plans to DESHS by December with additional money.
May 22, 2003	Meeting. Met with technical team members at DESHS.	Progress report, deadlines, mapping, mitigation actions, internal web page.
May, 2003	Gather mapping data.	Complete hazard identification and profile.
June, 2003	Website addressing natural hazards.	Public involvement and comment.
July 17, 2003	Meeting. Met with technical team members in Orem City.	Discussed mapping and plan review.
August, 2003	Public meetings. Handed out pamphlets about PDM.	Public involvement.
September 8, 2003	Meeting with WFRC GIS representatives.	Discussion of PDM plan and mapping technical issues.
September 8, 2003	Meeting with Price City PDM group.	Discussion of current regional PDM document draft and regional maps.
September 11, 2003	Meeting with Carbon County Planning Director.	Collection of development data for PDM regional plan (building permits data).
September 11, 2003	Meeting with Carbon County GIS Specialist.	Discussion of hazard map overlay format.
September 17, 2003	Submitted a byline on Pre-Disaster Mitigation.	Price Sun Advocate newspaper for Emergency Preparedness Supplement.
September 18, 2003	Training Meeting. Utah Division of Water Resources auditorium, SLC	
September 23, 2003	Pre-Meeting Emery County PDM coordinator and Emery County GIS team.	Discussed mapping technical issues.
September 23, 2003	Meeting with Emery County LEPC.	
September 24, 2003	Meeting with Blanding City GIS specialist.	Discussed PDM data and mapping technical issues.

September 24, 2003	Meeting with Grand County Planning Director and PDM representatives from Grand county and Moab City.	Discussed hazard identification and mitigation strategies.
September 25, 2003	Technical Meeting at Mountainland AOG.	Discussed PDM plan progress and technical issues.
September 25, 2003	Meeting with WFRC contact.	Discussed PDM plan draft issues and mapping.
September 29, 2003	Meeting with SEUALG executive director.	Talked about action plans for upcoming PDM meetings.
September 29, 2003	Strategy Meeting with Price City administrator, Carbon County GIS specialist, Price City PDM contact and SEUALG Executive Director.	Talked about action plans for upcoming PDM meetings.
October 7, 2003	Meeting with San Juan County Administrator.	Discussed PDM data collection and meeting coordination, open house plans, and fund allocation issues.
October 7, 2003	Meeting with Carbon county Commissioner and Price City PDM Contact.	Discussed coordination of PDM efforts and distribution of grant funds.
October 15, 2003	Training Meeting in St George.	PDM training Conference.
October 17, 2003	Meeting with Price City PDM representative.	Discussed Price/Carbon county PDM issues.
October 21, 2003	Meeting with Emery County PDM coordinator and Sheriff, et al.	Discussed mapping issues.
October 21, 2003	Meeting with Emery County LEPC.	Presented PDM progress report. Worked on PDM issues.
October 23, 2003	Open House. Grand County.	Display PDM maps and plan draft to public for review.
October 27, 2003	Meeting with Emery County PDM coordinator and Sheriff, et al.	Discussed mapping issues in preparation for Emery County PDM open house; worked out mitigation goals and objectives.
October 27, 2003	Meeting with Price/Carbon County PDM committee.	Viewed maps and worked out mitigation goals and objectives.
October 29, 2003	Open House. Emery County	Display PDM maps and plan draft to public for review.
October 30, 2003	Meeting with Carbon County GIS director.	Discussed PDM maps.
November 3, 2003	Open House. Price City/Carbon County.	Display PDM maps and plan draft to public for review.
November 4, 2003	Meeting with Green River City recorder and Mayor.	Discussed local PDM issues.
November 4, 2003	Meeting with Grand County Planner.	Discussed PDM mapping and mitigation strategies.

November 4, 2003	Meeting with San Juan county administrator.	Prepared for the San Juan County PDM open house.
November 4, 2003	Open House. San Juan County.	Display PDM maps and plan draft to public for review.
November 11, 2003	Public Hearing. Grand County.	Receive public comment on PDM maps and plan draft.
November 19, 2003	Meeting with Green River LEPC, Emery County Sheriff and PDM representative, Green River Mayor, and Green River City staff.	Discuss local PDM issues, view maps, and plan mitigation strategies.
November 20, 2003	Public Meeting. Price City and Carbon County.	Receive public comment on PDM maps and plan draft.
December 4, 2003	Meeting with Carbon County GIS specialist, Price City PDM representative, and Carbon County planner, et al.	Discussed remaining mapping issues and PDM mitigation strategies for Carbon County.
December 8, 2003	Meeting with Emery county Sheriff and PDM representative and PDM assistant.	Worked over PDM documentation issues and to set meetings with LEPC group members.
December 8, 2003	Meeting with Emery county IT and GIS specialist.	Discussed Emery county PDM mapping issues.
December 8, 2003	Meeting with East Carbon City Mayor and city recorder.	Viewed PDM maps and worked through Mitigation strategies for East Carbon and Sunnyside cities.
December 10, 2003	Met with Sunnyside Mayor and Recorder.	Viewed PDM maps and discussed Mitigation strategies for East Carbon and Sunnyside cities.
December 12, 2003	Meeting with Emery County LEPC group members et al.	Discussed PDM mapping and mitigation strategies.

A. Public Involvement

Public involvement opportunities were available throughout the drafting of this plan. Such opportunities included a public website for comment and review, public meetings, and newspaper articles announcing the public meetings. Each plan of the seven natural hazard mitigation plans was placed on the DES website. This website allowed viewers to submit comments electronically by clicking on a submit comments button. Emergency managers, fire departments, sheriff departments, state and local agencies, community members, business leaders, educators, non-profit organizations, private organizations, and other interested people were all a part of the planning process. Intent to complete a mitigation plan was presented at each of the four county commissions, which were open to the public. The state presented the concept of PDM planning at the elected officials conference in August of 2002 and received numerous comments. Appropriate measures were taken to include those comments that would benefit the plan. The following is a copy of an article written by SEUALG community planning director Jeff Adams, taken from a local paper (Price Sun Advocate, Figure 3-1). Also attached are public notices and information related to natural hazards and mitigation planning from the local newspapers (Figure 3-2, 3-3, 3-4).

Figure 3-1 Price Sun Advocate Newspaper Clipping

Hazard Mitigation

Hazard Mitigation can be defined as reducing or "softening" the effects of hazards on people and property. Where emergency response is primarily concerned with reacting to events, pre-disaster mitigation works to identify and reduce the risk of potential hazards before they occur.

Hazard Mitigation comes in two basic flavors; those things designed to separate hazards from people, property, and structures, (like retaining walls and fire breaks) and those that keep people, property and structures away from hazards (such as zoning codes that don't let people build in floodplains).

Price City and Carbon County are working together to create maps showing where catastrophic events might occur. They do this by taking one "layer" of data such as the route of a flood or dam failure deluge might take, and placing it over another "layer" on the same map that shows where houses and buildings are located. When these two layers are combined, it is easy to tell which houses and stores will be in the path of the flood.

Once the hazards are mapped, city and county leaders, engineers, planners, and other experts come together to prioritize the hazards. This is done by taking two ideas, namely, the risk factor ("is this really likely to happen?") and the damage potential ("how many people could this hurt?") and creating a priority table. Those hazards that have *both* a high risk factor *and* a high damage potential have the highest priority and are addressed first.

The team then takes these high priority items and sets very broad goals. For example, if dam failure was identified as both highly likely and dangerous to many people, a goal might be as follows: "to decrease the potential of flood-related deaths and injuries."

When hazards are identified and Goals are spelled out, the plan is submitted to the state and to the Federal Emergency Management Agency (FEMA) for approval. Once approved, this plan allows state and local communities to obtain FEMA grants to be used for mitigation measures.

Figure 3-2 Article found in the October 7th 2003 Emery County Progress Internet Newspaper

County Prepares for Emergencies

By PATSY STODDARD
Editor

Is Emery County prepared for a disaster? That is exactly the question that the Local Emergency Planning Committee is trying to answer. The LEPC is made up of representatives from local agencies such as the Emery County Sheriff's Office, mayors of local communities, school board representative, neighborhood watch, health department, road department, water conservancy district and many others.

You might wonder what all of these organizations have in common. In the event of a disaster these agencies all need to coordinate and cooperate to facilitate an organized effective response to whatever situation arises.

Martin Wilson is a sergeant from the Emery County Sheriff's Office and is chairman of the LEPC committee. He recently named Jed Jensen as the co-chairman for the committee.

The committee meets monthly to coordinate efforts and address needs.

A the recent LEPC meeting, Sgt. Wilson called for a list of items on hand in each of the cities that would be available for use should an emergency situation arise. This inventory of items would include ambulances, heavy equipment- type and amount and other items.

Part of the planning procedure is the development of a list of hazards and a history of past emergencies to develop a current list and develop as part of the hazard plan. Identifying and prioritizing possible hazards such as earthquakes, flooding and others to identify those most likely to happen in Emery County and to prepare accordingly. The Association of Governments has listed hazards as a starting point for evaluation by the LEPC committee. Areas where flood plains have been identified and maps of such plains are in existence with the AOG and can be utilized in emergency planning. Planning ahead to remedy flood situations or at least being aware of where floods will occur is part of the process.

Daryl Wilcox, Elmo mayor, was also concerned about maps, which show the power lines and gas transmission lines in the event of a disaster. He said these types of maps would be helpful to have on hand and in place in emergency response vehicles. His concern also was for other areas of the country, which rely on the Emery County power plants for their power supply.

He also said that overlays of these transmission lines can be obtained from the various utility companies and can be used on geographic reference visual maps, which they already have.

A part of the disaster plan should also include who is responsible for the costs associated with a hazardous chemical spill from trucking or railroad.

Terry Wright from the health department said that she will be working on a list of nurses, EMT's, firefighters and mental health workers who might be available to help in a disaster, even if they are not currently working in the medical field, but who are trained to do so.

Sgt. Wilson reported that as always they are looking for avenues of funding to increase the EMT skills of already practicing EMT's in the county.

SEUALG Community Planning Director Jeff Adams talked about the steps toward having a workable emergency plan. One step is to have a valuation of property in any given emergency situation and to be able to prioritize risk factors and situations. For example with a wildfire the priority could be low, but a wildfire near a subdivision of mountain homes becomes top priority for action. These risk factors would be identified and gauged by probability of its occurrence in our area. A tornado for example would be listed as low risk and low priority, but a flood would be given much higher priority in the plan and appropriate action plans identified and implemented.

Each strategy for each hazard has goals. The goal in a flood situation would be to keep people from drowning. Human life is the first priority and property comes in second. Goals also include action plans for preventing flooding, such as shoring up a canal or other measures which would involve the road department and the water conservancy district. Funding to complete these goals also must be looked into.

Plans for what should be done in the event of a dam break will also be addressed in the plan and determining the flood zone for each of the dams. Mayor Wilcox also requested that plans for the surveying of the dams and data and information be kept as well as seismic analysis of the dams in the county.

There is an emergency preparedness fair in Carbon County on Oct. 9 at the St. Matthew's church beginning at 2 p.m., which should provide useful information for interested county residents.

Figure 3-3 Public Notice found in the October 28th 2003 Emery County Progress and Price Sun Advocate Newspapers

Public Notice:

PUBLIC HEARING NOTICE

The Southeastern Utah Association of Local Governments will hold a public hearing to consider potential projects for which funding may be applied under the CDBG Small Cities Program for FY2004-2005. Suggestions for potential projects will be solicited, both verbally and in writing from all interested parties. The expected amount of CDBG funds for this funding year will be discussed along with the range of projects eligible under this program and a review of previously funded projects. The hearing will begin at 10:00am on November 6, 2003 and will be held in the Board Room of the Carbon Credit Union at 675 E. 100 N. Price, UT 84501. Further information can be obtained by contacting Debbie Hatt at 435-637-5444. In compliance with the Americans with Disabilities Act, individuals needing special accommodations (including auxiliary communicative aids and services) during the hearing should notify Debbie Hatt at the SEUALG, 375 S. Carbon Ave., Price, Utah 84501, 435-637-5444 at least 5 working days prior to the hearing.
Published in the Emery County Progress October 28, 2003.

Public Notice ID: 2241910.HTM

Top of Form

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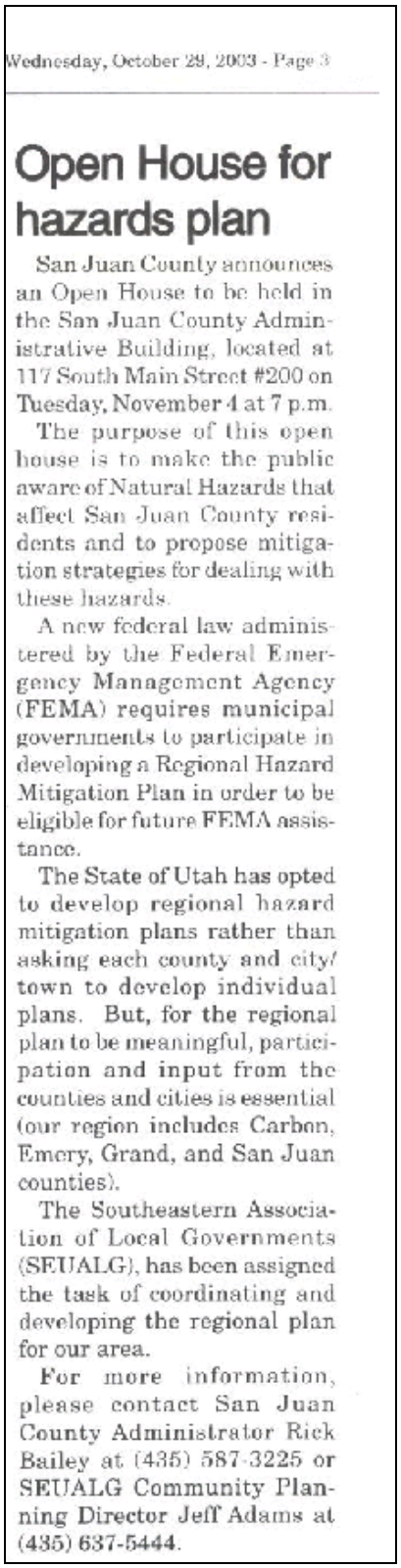
Figure 3-4 Article found in the October 29th 2003 San Juan Record Newspaper



Wednesday, October 29, 2003 - Page 3

Open House for hazards plan

San Juan County announces an Open House to be held in the San Juan County Administrative Building, located at 117 South Main Street #200 on Tuesday, November 4 at 7 p.m.

The purpose of this open house is to make the public aware of Natural Hazards that affect San Juan County residents and to propose mitigation strategies for dealing with these hazards.

A new federal law administered by the Federal Emergency Management Agency (FEMA) requires municipal governments to participate in developing a Regional Hazard Mitigation Plan in order to be eligible for future FEMA assistance.

The State of Utah has opted to develop regional hazard mitigation plans rather than asking each county and city/town to develop individual plans. But, for the regional plan to be meaningful, participation and input from the counties and cities is essential (our region includes Carbon, Emery, Grand, and San Juan counties).

The Southeastern Association of Local Governments (SEUALG), has been assigned the task of coordinating and developing the regional plan for our area.

For more information, please contact San Juan County Administrator Rick Bailey at (435) 587-3225 or SEUALG Community Planning Director Jeff Adams at (435) 637-5444.

B. Information Sources

The following information sources and plans were reviewed during the completion of this plan.

- National Weather Service (hazard profile).
- National Climate Data Center (drought, severe weather)
- Army Corps of Engineers (flood data).
- Utah Division of Emergency Services and Homeland Security (Salt Lake City Mitigation Plan, GIS data, flood data, HAZUS data for flood and earthquake).
- Utah Geologic Survey (GIS data, geologic information).
- Utah Division of Forestry Fire and State Lands (fire data).
- Utah Avalanche Center, Snow and Avalanches in Utah Annual Report 2001-2002 Forest Service.
- Utah Automated Geographic Resource Center (GIS data).
- University of Utah (drought climate charts from internship students).
- University of Utah Seismic Station (earthquake data).
- Utah State University (climate data).
- Councils of Government
- Association of Governments
- Elected of Officials from participating communities
- Carbon County and municipalities (Emergency Operations Plans, histories, mitigation actions, public input, GIS data, assessor data, transportation data, property and infrastructure data).
- Emery County and municipalities (Emergency Operations Plans, histories, mitigation actions, public input, GIS data, assessor data, transportation data, property and infrastructure data).
- Grand County and municipalities (Grand County Storm Drainage Master Plan, Moab City Project Impact 2000, Moab City Hazard Mitigation Plan 2000, Emergency Operations Plans, histories, mitigation actions, public input, GIS data, assessor data, transportation data, property and infrastructure data).
- San Juan County and municipalities (San Juan County Drought Plan, San Juan County Water Master Plan, Emergency Operations Plans, histories, mitigation actions, public input, GIS data, assessor data, transportation data, property and infrastructure data).
- Private individuals from the community

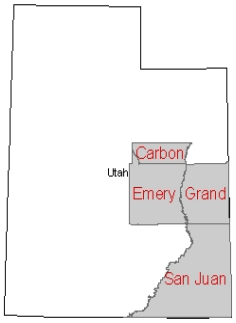
Other Plans:

- Earthquake Safety in Utah
- Utah Natural Hazard Handbook
- Utah Statewide Fire Risk Assessment Project
- A Strategic Plan for Earthquake Safety in Utah
- Natural Disaster Analysis, State of Utah Office of Emergency Services 1976
- State of Utah Mitigation Plan 1999 and 2001
- State of Utah Wildfire Plan 2002
- State of Utah Drought Plan
- State of Utah Water Plan
- Salt Lake City Mitigation Plan 2002
- Planning for a Sustainable Future
- Town of Merrimack, NH Hazard Mitigation Plan 2002
- Clackamas County Mitigation Plan 2002
- Hazard Mitigation Plan Dunkerton, Iowa
- Dunn County North Dakota Multi-Hazard Mitigation Plan 2001
- Jefferson County West Virginia All Hazard Mitigation Plan 2003

Part 4. Regional Data

Southeastern Region

The Southeastern Utah Association of Local Governments (SEUALG) encompasses Carbon, Emery, Grand, and San Juan Counties. The Southeastern region, known as Canyon Country, is part of the Colorado Plateau Physiographic province. This region is known for its colorful high desert plateaus and extreme elevation changes from deep river gorges to high mountain peaks.



A. Geographic and Physiographic Background

Carbon County

Carbon County is in the eastern central portion of the state, surrounded by the Book Cliff range to the north, the San Rafael Swell to the south, and the Wasatch Plateau to the west. The area topography includes both mountainous regions and desert terrain. Price City sits at an elevation of approximately 5,500 feet above sea level. Mancos shale is abundant, consisting of calcite, aragonite, marine fossils, coal, jet and carbonized plant life. The Green River Formation of the Roan Cliffs contains untapped oil shale, which is "a mixture of organic and mineral sediments that were deposited in a large lake" (Barnes 125).

Price City, incorporated in 1911, is the county seat and the largest town in Carbon County with a population of approximately 9,086. Carbon County comprises 1,479 square miles of land area and is ranked 20th in the State. In terms of arable land, the county is ranked thirteenth in the state, with 291,860 acres (Carbon County).

Emery County

Emery County is comprised of unique geography consisting of high desert plateaus, buttes, valleys, as well as mountainous regions, fertile valleys, and desert. Castle Valley is the most populated area in the county and is characterized by its high desert plateaus and buttes. Castle Dale is 5,771 feet above sea level. The highest point in Emery County, East Mountain, is 10,743 feet above sea level (Emery County). The San Rafael Swell desert is a unique geographic area within Emery County. It is distinguished by its desert canyons and occupies an area 80 miles north/south and 40 miles east/west. Emery County is bordered by Grand County and the Green River on the East, Carbon County on the North, Sanpete and Sevier Counties on the west, and Wayne County to the South (Emery County Utah). The Book Cliffs are made up of Cretaceous rocks and Mancos shale, also known as the Mesa Verde group. The Roan Cliffs are Tertiary lake deposits from the Paleocene and Eocene Epochs. The Roan Cliffs have the largest deposit of tar sand in the United States in beds 10 to 300 feet thick. The Mesa Verde escarpment as well as the Mancos shale found here provides coal for nearby power plants. The Cleveland-Lloyd Dinosaur quarry houses bones of Jurassic reptiles found in the Morrison formations; they are thought to be about 147 million years old (Chronic, Halka). The county seat is located in the population center of Castle Dale City, with a Census 2000 population of 1,657.

Grand County
Grand County has a total area of 3,694 square miles; Moab city is the most populated and most traveled to city in Grand County. Elevations range from approximately 4,000 feet above sea level in Moab to over 12,000 feet above sea level in the La Sal Mountains, just 18 miles east of Moab. The geography is diverse and is distinguished by meadows, lakes, and streams within aspen forests and mountainous regions to desert canyons of the Moab Area. Oil, gas, propane, butane, natural gas, uranium, vanadium, and copper are all found in Grand County. The Lisbon Valley hosts several salt anticlines that trap oil and gas. Petroleum products, uranium, and vanadium are drawn from these formations (Lisbon Valley also in San Juan County). Copper has been mined in nearby faults along the edge of the Lisbon Valley salt anticline (Chronic, Halka).

San Juan County
San Juan County is the largest county in the State of Utah, encompassing 7,800 square miles. The physiographic features of the area include high mountains and plateaus, desert, high desert mountains, and rugged canyons. Elevations range from 3,160 feet above sea level along the Colorado River to 13,089 feet above sea level on Mt. Paele in the La Sal Mountains. San Juan County is part of the four corners region and is bordered by Arizona on the South; Colorado on the East; Wayne, Kane and Garfield Counties on the West; and Grand County on the North. Two Indian reservations are located within the county, namely the Navajo Nation and the Ute Indian Reservation on White Mesa. San Juan County vegetation consists of Douglas fir, sub alpine forb, grassland, Engelmann spruce/ sub alpine fir, aspen, ponderosa Pine, mountain brush, pinyon-juniper, sagebrush, oak brush, and riparian types including willow, cottonwood, cacti and alder. The principle topographic geologic features include the Four Corners Platform in the east; the Paradox Salt Basin and attendant fold and fault belt in the northeast; and the Monument Upwarp with linked Comb Ridge monocline and Blanding sub-basin in the central portion and in the extreme southwest. Igneous intrusions of Tertiary age core the La Sal and Abajo mountains. The La Sal and Abajo mountains are important sources of surface water during the spring runoff (San Juan County Emergency).

B. Geology

Rock types in the Canyon Country are composed mainly of sedimentary rocks including: sandstone, mudstone, siltstone, shale, limestone, gypsum, sand dunes, and conglomerates. The oldest sedimentary rocks date back to Paleozoic time and can be found at Monument Upwarp, the San Rafael Swell, and near the eastern border of Utah in smaller anticlines. Most of the sediment of which the rocks are comprised of was deposited during the Triassic, Jurassic, and Cretaceous periods. The Roan Plateau in the Uintah Basin contains Tertiary and Quaternary rocks. Tertiary rocks include members of the Wasatch Group, namely the North Horn Formation, Flagstaff Limestone, Colton Formation, and Green River Shale. The Abajo Mountains, the Henry (near Hanksville in Wayne County), and the Navajo Mountains (south of Lake Powell) are all laccolith mountains, created by molten rock that forced its way upward along crustal faults and horizontally along the layers of weaker compressed sedimentary strata. Igneous activity can be easily identified in the area by the volcanic necks, conduits, dikes and lava-capped plateaus (Refer to Table 4-1 “Geologic Time Scale” for explanation of geologic time.)

Moab and Lisbon Valley are salt anticlines. They are the result of glacial like sand including gypsum and potash being pushed up along faults. Gypsum and potash are less dense than the surrounding rocks and generally result in very unstable areas. Salt anticlines in this region trap upward migrating oil and gas. Oil, uranium, natural gas and some copper, potash, and gypsum are the main types of extracted resource in the southeastern area of the state. (Barnes 32-61, 91)

Table 4-1. Geologic Time Scale

Ages or Eras	Millions of Years Ago	Period		Epoch
CENOZOIC	0-1.8	QUATERNARY		Holocene
				Pleistocene
	1.8-65	TERTIARY		Pliocene
				Miocene
				Oligocene
				Eocene
				Paleocene
MESOZOIC	65-145	CRETACEOUS		Late
				Early
	145-213	JURASSIC		Late
				Middle
				Early
	213-248	TRIASSIC		Late
				Middle
				Early
PALEOZOIC	248-286	PERMIAN		Late
				Early
	286-360	CARBONIFEROUS	PENNSYLVANIAN	Late
			MISSISSIPIAN	Early
	360-410	DEVONIAN		Late
				Middle
				Early
	410-440	SILURIAN		Late
				Middle
				Early
	440-505	ORDOVICIAN		Late
				Middle
				Early
	505-544	CAMBRIAN		Late
				Middle
				Early
PRE-CAMBRIAN	544-4.5 billion years ago, time from the beginning of earth.			
Source: U. S. Geological Survey, Paleontology website: http://geology.er.usgs.gov/paleo/				

C. Climate

Southeastern Utah's climate is arid/semi-arid, characterized by cold and dry winters and warm summers at elevations less than 5,000 feet above sea level. Summer temperatures usually reach into the high 90s and winter temperatures generally are between 10 degrees to 20 degrees Fahrenheit. The average annual precipitation is approximately 10 inches but can range from 6 to 30 depending on elevation, while the average annual snowfall is about 15 inches. Frost-free days vary from 231 at the Hite Marina to 119 days at the La Sal Mountain Range.

D. Major Rivers

The main source of surface water generated in the planning area is from laccolithic mountains such as the La Sal and Abajo's. These mountains rise above the sandstone basin and create uplift and greater precipitation. The Colorado River and the two main tributaries, the Green River and San Juan River flow through the planning area southwesterly into Lake Powell. In the mid-1960s, the Glen Canyon Dam was completed impounding the Colorado River and creating Lake Powell. This dam was very controversial and the opposition helped shape policies toward the concept of water management and environmental protection (Colorado River Basin). Other major rivers in the region include the San Rafael, Green, Dolores River, and many smaller tributaries. Groundwater is withdrawn from two types of aquifers in this region, consolidated rock and unconsolidated deposits. Most of the water is utilized for irrigation. As the water demand increases with the growing population, water management will need to become more efficient. The main rivers as well as the ephemeral rivers are all subject to flooding in southeastern Utah.

E. Regional Hazards

Due to the geographic extent these hazards have not been mapped and risk assessments were unable to be compiled. Therefore all of the information for the following regional hazards is in the narrative below. The entire region is subject to these hazards with no unique risk affecting a single jurisdiction. Refer to each county section for a list of historical hazard events.

1. Severe Weather

Hazard Profile

Potential Magnitude	X	Negligible	Less than 10%
		Limited	10-25%
		Critical	25-50%
		Catastrophic	More than 50%
Probability	X	Highly Likely	
		Likely	
		Possible	
		Unlikely	
Location	Occur in very localized areas throughout the region, unable to identify exactly when and where the next event will take place.		
Seasonal Pattern or Conditions	Based on climate, elevation, and precipitation.		
Duration	Severe Weather hazards generally last hours and can last days.		
Analysis Used	National Climate Data Center, National Weather Service, Utah Avalanche Center, Utah DESHS, local input, and review of historic events and scientific records.		

Description of Location and Extent

Severe weather includes High Winds, Severe Storms (Thunderstorms, Lightning, Hailstorms, Heavy Snow or Rain, Extreme Cold), Tornado, and Avalanche.

High Winds

High winds can occur with or without the presence of another storm and are determined to be unpredictable in regards to time and place. Each of the four counties that make up Southeastern Utah has experienced high winds in the past, generally during the spring and summer months. These counties can expect regional high wind events in the future. Winds are usually strongest near the mouths of canyons and have resulted in the loss of power and the inability to heat homes and businesses. Winds in the past have damaged roofs, destroyed and knocked down large trees and fences, overturned tractor -trailers, railroad cars, and small airplanes.

Severe Storm

Severe storms can include thunderstorms, hailstorms, heavy snow or rain, and extreme cold. They are generally related to high precipitation events during the summer and winter months. Severe storms can happen anywhere in the region and the damage can be extensive especially for agriculture, farming, and transportation systems. They can also disrupt business due to power outages.

Thunderstorms

A thunderstorm is a storm made up of heavy rain or hail along with thunder and lightning resulting from strong rising air currents. Based on historical evidence thunderstorms can strike anywhere in the region mainly during the spring and summer months

Lightning

Lightning is the electric discharge accompanied by light between clouds or from a cloud to the earth. In Utah, lightning is the number one natural hazard killer. Lightning can also start wildland fires, which could be potentially fatal or disruptive.

Hailstorms
Hailstorms occur when freezing water in thunderstorm type clouds accumulates in layers around an icy core generally during the warmer months of May through September. Hail causes damage by battering crops, structures, and automobiles. When hailstorms are large (especially when combined with high winds), damage can be extensive. The risk of hailstorms is not targeted to any particular areas within the region.

Heavy Snow or Rainfall
Heavy amounts of precipitation from rain or snow can result in flash flood events. Historically, This region has been susceptible to these types of storms in the past. Major winter storms can produce five to ten times the amount of snow in the mountains than in the valley locations.

Most of the valley's development occurs on old alluvial fans from the canyon mouths. During heavy precipitation flood waters and debris will occur on these same alluvial fans, damaging residential and commercial property along with infrastructure. The associated threat with heavy snowfall is avalanches.

Extreme Cold
Sub-zero temperatures occur during most winters, however prolonged periods of extremely cold weather are infrequent. January is generally the coldest month of the year. Historically extreme cold in the region has disrupted agriculture, farming, and crops. Extreme cold also affects life, especially vulnerable are the young and elderly and animals.

Avalanche
Avalanches occur on steep slopes and therefore the mountainous areas as well as the foothills around the region are all vulnerable. Even though most avalanches occur on forested lands they affect mostly city and county dwellers. Therefore, avalanches should be given a priority in Utah due the number of historical occurrences. The money spent to respond, and recover from an avalanche in addition to the man-hours and property affected by a slide is usually on or given by the city and/ or county.

The probability of a future event is likely dependant on the amount of heavy snowfall during a given year. Most deadly avalanches occur in the backcountry away from developed areas. Avalanche control is performed regularly in developed ski areas to minimize the threat and increase awareness. The Avalanche Center was initiated as another resource for measuring risk and increasing awareness to the residents of the Southeastern region.

Tornado
Historically, atmospheric conditions have not been favorable for the development of tornadoes in Utah due to the dry climate and mountainous terrain. Utah averages about two tornados per year. Utah tornados are usually no more than 60 feet wide at the base and last up to 15 seconds. Tornadoes occur during the months of May, June, July, and August usually preceding a cold front. Utah is one of the lowest ranked nations for incidences of tornadoes with only one F2 or stronger tornado every seven years.

2. Drought

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
		Limited	10-25%
	X	Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
	X	Likely	
		Possible	
		Unlikely	
Location	Countywide		
Seasonal Pattern or Conditions	Summer		
Duration	Months, Years		
Analysis Used	National Weather Service, Utah Climate Center, National Geophysical Data center- Natural Hazards Database, Newspapers, Local input.		

Description of Location and Extent

Drought refers to an extended period of deficient rainfall relative to the statistical mean for a region. The entire region is currently experiencing a drought from 1999- present. Drought dramatically affects this area because of the lack of water for agriculture and industry, which limits economic activity, irrigation and culinary uses. The severity of the drought results in depletion of agriculture lands and deterioration of soils. In the Southeastern region the risk of drought is high.

Drought is not targeted to any particular area within the region and the geographic extent of drought is hard to identify or map on a local or even county level. During the making of this plan, drought related GIS layers were unavailable to complete the mapping and analysis portions of the plan. Therefore, a vulnerability analysis including types and numbers of buildings, critical facilities, and infrastructure affected by drought were unable to be determined.

The secondary threats associated with drought include infestation and wildfire, all of which the region as historically been susceptible to. For a further explanation of infestation and wildfire refer to the Part 6 Risk Assessment, Section E Hazard Description.

The Palmer Drought Severity Index developed by Wayne Palmer in the 1960's, measures drought severity using temperature and rainfall to determine dryness. The Palmer Drought Severity Index or (PDSI) has become the "semi-official" drought index as it is "standardized" to local climate and can be applied to any part of the country. The PDSI uses zero as normal and assigns a monthly numerical id between +6 and -6 with, server droughts having higher negative numbers. Thus, a moderate drought is minus 2, a sever drought minus 3, and extreme drought is minus 4. Excess rain is expressed using plus figures, with plus 2 representing moderate rainfall, etc. Figure 4-1 is a map of Utah’s climate divisions. Refer to Figure 4-2 for a complete Palmer Drought history for Southeastern Utah.

Figure 4-1 Utah Climate Divisions

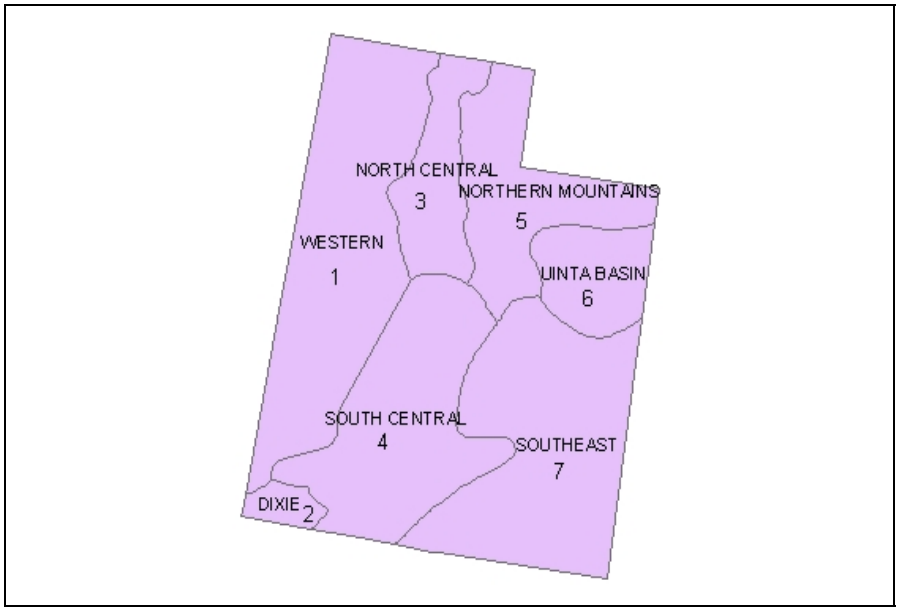
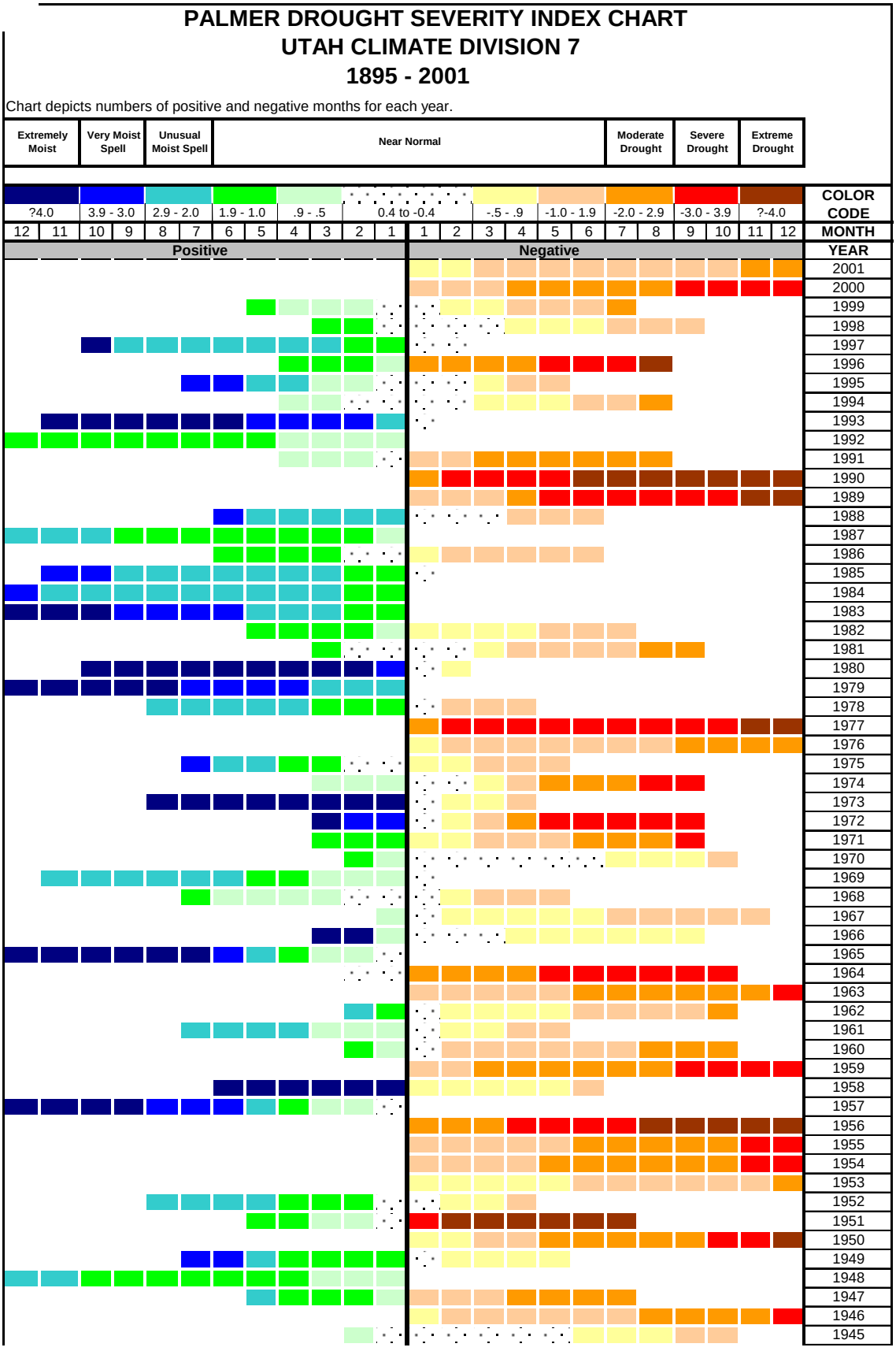
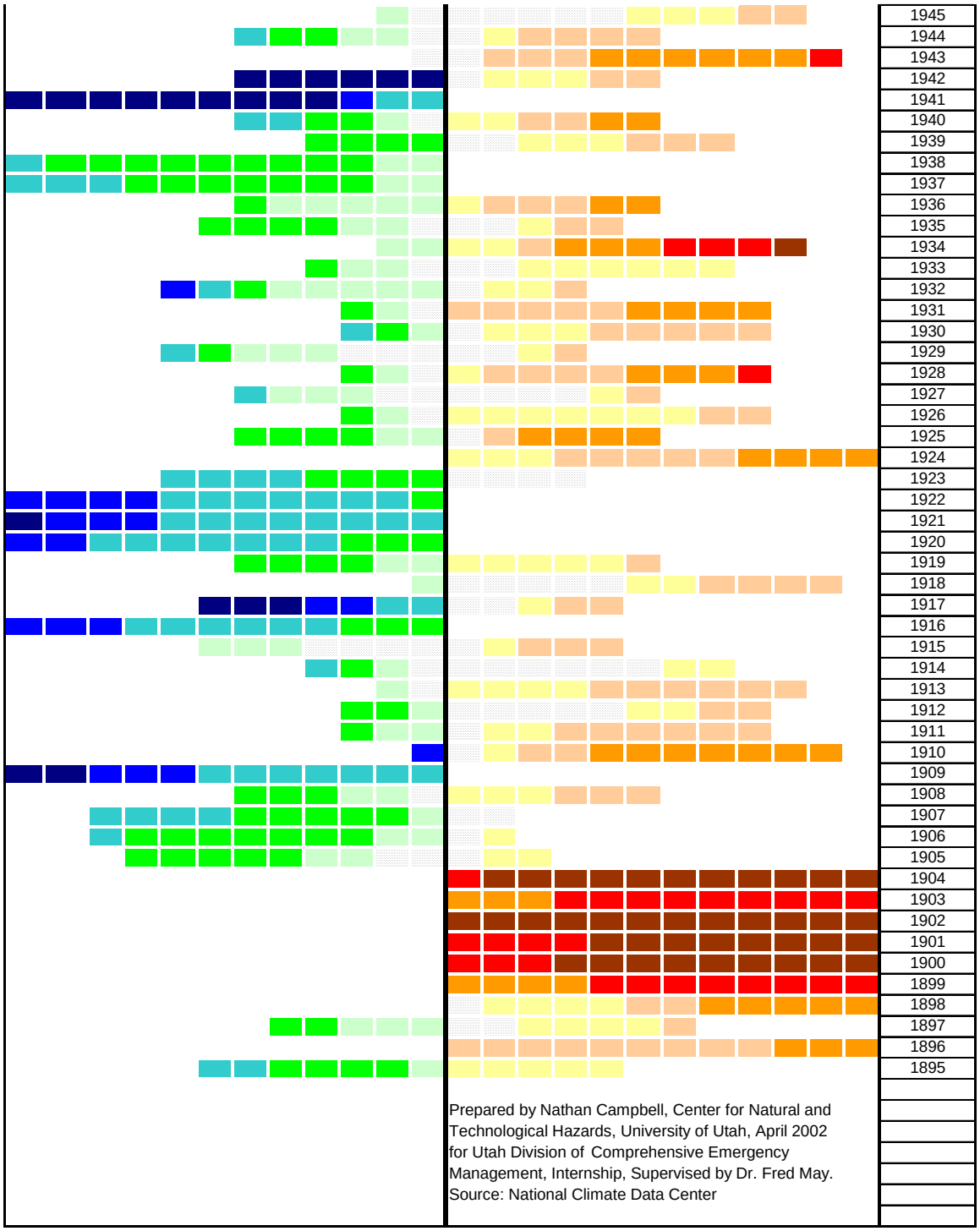


Figure 4-2 Climate Division Number 7 Southeast

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Prepared by Nathan Campbell, Center for Natural and Technological Hazards, University of Utah, April 2002 for Utah Division of Comprehensive Emergency Management, Internship, Supervised by Dr. Fred May.
Source: National Climate Data Center

3. Earthquake

Potential Magnitude		Negligible	Less than 10%
		Limited	10-25%
	X	Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
	X	Likely	
		Possible	
		Unlikely	
Location	Seismic clustering. Ground shaking can be felt throughout the entire region. Surface fault rupture can be felt in areas of known historic fault zones. Liquefaction can be expected in areas of high to moderate liquefaction potential. See maps in Section H.		
Seasonal Pattern or Conditions	Seasonal Pattern: There is no seasonal pattern for earthquakes, they can occur at any time of the year or day during no, any, or all weather conditions. Conditions: Liquefaction Potential within high ground water table. Soil that is comprised of old lakebed sediments. Historic movement along faults.		
Duration	Actual ground shaking will be under one minute, aftershocks can occur for weeks or even months.		
Analysis Used	Review of hazard analysis plans and other information provided by the University of Utah Seismograph Station, UGS, USGS, DESHS, AGRC.		

Description of Location and Extent

The Southeastern region's earthquake threat from the Intermountain Seismic Belt and other crustal rock strain release areas is minimal, with a limited risk due to the large areas of undeveloped lands and smaller number of faults. During historic time the largest recorded earthquake has not reached above 5.3 on the Richter magnitude scale, yet geologic investigation has determined much larger events have happened in the recent geologic past and could happen in the future. These events are associated with numerous faults, which exhibit signs of prior movement during the quaternary time period or last 1.6 million years: These faults are listed below:

- Little Delores River
- Ryan Creek fault zone
- Granite Creek fault zone
- Sinbad Valley Graben
- Paradox Valley
- Pleasant Valley
- Joes Valley fault zone (<15,000 years)
- Southern Joes Valley fault zone
- Price River
- Ten Mile Graben
- Salt and Cache Valleys faults
- Sand Flat Graben
- Moab and Spanish Valley
- Castle Valley
- Fisher Valley
- Needles fault zone (<15,000 years)
- Lockhart fault
- Lisbon Valley Fault zone
- Pine Ridge
- Shay Graben
- Bright Angel fault system

Seismic clustering is evident throughout most of the region and is mainly associated with underground mining, most of the recorded earthquake activity is coal mining related.

Risk assessments were completed for part of the region and can be found below under each county heading.

Building Damage by Count
Building damage is classified by HAZUS MH in five damage states: none, slight, moderate, extensive and complete. The Building Damage Tables list the number buildings by occupancy, which are estimated to have moderate to complete levels of damage.

Debris Removal
The Debris Removal table's show how much debris would be generated by the earthquake and how many loads it would take to remove the debris, based on 25 tons per load. One truck can likely haul one load per hour. A second debris removal issue is landfill space. Fifty thousand tons (50,000) at a weight to volume ratio of one ton per cubic yard would cover more than ten acres to a depth of three feet.

Fire Following
The Great San Francisco Earthquake of 1906 illustrated the hazard a city could face from fire following an earthquake. Multiple ignitions and broken water mains conspired to make firefighting nearly impossible. HAZUS uses the estimated building damages, loss of transportation infrastructure and estimated winds to calculate the estimated area that would be burned following an earthquake. The fire tables provide estimates of ignitions, people at risk and the building stock exposed to fires following an earthquake. These numbers were derived from a HAZUS MH run based on a probabilistic 2500-year event with a magnitude 7.0 running the soils portion of the model.

A. Carbon County

The active coalfields near East Carbon/ Sunnyside, Hiawatha/ Wattis, Castlegate, and Soldier Canyon all affect the earthquake seismicity due to the underground coal extraction methods, creating numerous small earthquakes. The following tables generated using HAZUS MH demonstrate numbers of at risk for of people and property damaged in an earthquake.

Vulnerability Assessment

Table 4-1 Casualties

Casualties	Nighttime –Minor	3
	Nighttime –Major	0
	Nighttime -Fatalities	0
	Daytime –Minor	90
	Daytime –Major	3
	Daytime- Fatalities	6
	Commute –Minor	63
	Commute –Major	2
	Commute-Fatalities	3

Table 4-2 Building Damage by Count with Moderate to Complete Damage

Category	Number of Structures
Residential	765
Commercial	38
Industrial	0
Totals	2,952*

*****Includes all building categories with moderate to complete damage

Table 4-3 Critical Facilities

Classification	Total	Least Moderate Damage >50%	Complete Damage > 50%	Functionality > 50% at day 1
Hospitals	1	0	0	0
Schools	14	0	0	2
EOC's	0	0	0	0
Police Stations	5	0	0	1
Fire Stations	4	0	0	1

Table 4-4 Debris Generated (thousands of tons)/Loads to Remove Debris

Debris Generated	108
Loads (25 tons per load)	4,320

Table 4-5 Fire Following Event, Population Exposed, and Building Stock Exposed

Ignitions	2
People Displaced	12
Value Exposed (thousands $)	752

B. Emery County

Most of the earthquake activity in Emery County is located northwest of Orangeville and Castle Dale. None of these seismic clusters registered above a 3.0 on the Richter scale. Fault Zones are located along the western border of the county as well as in the northeastern half of the county. The Joe's Valley Fault is still active and has shown surface movement within the past 10,000 years. It has the potential of producing an earthquake with a Richter magnitude between 6.5 and 7.5, and causing damage to communities just east of the fault. A significant number of the recorded earthquakes in the county are associated with mining activities. The largest recorded earthquakes were 5.3 and 4.4,on the Richter scale, recorded on August 14 and 18th 1988 respectively. Both earthquakes were located in the southwestern area of Buckhorn Flat.

Vulnerability Assessment

Table 4-6 Casualties

Casualties	Nighttime –Minor	83
	Nighttime –Major	2
	Nighttime -Fatalities	3
	Daytime –Minor	78
	Daytime –Major	3
	Daytime- Fatalities	5
	Commute –Minor	69
	Commute –Major	2
	Commute-Fatalities	4

Table 4-7 Building Damage by Count with Moderate to Complete Damage

Category	Number of Structures
Residential	677
Commercial	23
Industrial	2
Totals	1,970*

*****Includes all building categories with moderate to complete damage

Table 4-8 Critical Facilities

Classification	Total	Least Moderate Damage >50%	Complete Damage > 50%	Functionality > 50% at day 1
Hospitals	0	0	0	0
Schools	10	1	0	1
EOC's	0	0	0	0
Police Stations	4	0	0	2
Fire Stations	7	2	0	1

Table 4-9 Debris Generated (thousands of tons)/Loads to Remove Debris

Debris Generated	65
Loads (25 tons per load)	2,600

Table 4-10 Fire Following Event, Population Exposed, and Building Stock Exposed

Ignitions	1
People Displaced	0
Value Exposed (mill. $)	0

C. Grand County

The following faults within Grand County showing signs of movement during the quaternary period: Fisher Valley, Ryan Creek, Granite Creek, Sinbad Valley Graben, Ten Mile Graben, Salt and Cache Valleys, Moab Fault and Spanish Valley, Castle Valley,

Vulnerability Assessment

Table 4-11 Casualties

Casualties	Nighttime –Minor	1
	Nighttime –Major	0
	Nighttime -Fatalities	0
	Daytime –Minor	9
	Daytime –Major	0
	Daytime- Fatalities	0
	Commute –Minor	6
	Commute –Major	0
	Commute-Fatalities	0

Buildings/Structures

Table 4-12 Building Damage by Count with Moderate to Complete Damage

Category	Number of Structures
Residential	431
Commercial	8
Industrial	0
Totals	661*

*****Includes all building categories with moderate to complete damage

Table 4-13 Critical Facilities

Classification	Total	Least Moderate Damage >50%	Complete Damage > 50%	Functionality > 50% at day 1
Hospitals	1	0	0	1
Schools	6	0	0	6
EOC's	0	0	0	0
Police Stations	2	0	0	2
Fire Stations	3	0	0	3

Table 4-14 Debris Generated (thousands of tons)/Loads to Remove Debris

Debris Generated	14
Loads (25 tons per load)	560

Table 4-15 Fire Following Event, Population Exposed, and Building Stock Exposed
No post-quake fire population or building stock has been identified.

D. San Juan County

There have been 28 recorded earthquakes in the County larger than 2.0 with 8 of them larger than 3.0 in the last 40 years. The largest earthquake was a 3.37 on May 13 1993 near Monticello.

San Juan County is made up of the following active faults along the northwestern boundary of the County: Needles Fault Zone, Bright Angel Fault Zone, Lisbon Valley Fault Zone, Lockhart Fault, Pine Ridge Fault, Moab Fault, and the Spanish Valley Fault. The Needles Fault Zone is a Holocene fault that runs from the confluence of the Green and Colorado Rivers and continues downstream to Gypsum Canyon. Holocene faults are known to be active and can generate an earthquake at any time. The Bright Angel Fault system extends from Mt. Holmes and the Mt. Ellsworth area southeast to Red Rock Plateau southwest to Navajo Mountain. The Lisbon Valley Fault Zone runs southeast from La Sal Junction. The Lockhart Fault cuts across Lockhart Canyon. The Pine Ridge Faults are east of La Sal. The Moab and Spanish Valley Faults run southeast into Moab. These faults are considered to be Quaternary and still are capable of generating earthquakes but the chances are significantly less.

Vulnerability Assessment

Table 4-16 Casualties

Casualties	Nighttime –Minor	8
	Nighttime –Major	0
	Nighttime -Fatalities	0
	Daytime –Minor	6
	Daytime –Major	0
	Daytime- Fatalities	0
	Commute –Minor	6
	Commute –Major	0
	Commute-Fatalities	0

Table 4-17 Building Damage by Count with Moderate to Complete Damage

Category	Number of Structures
Residential	223
Commercial	4
Industrial	0
Totals	427*

*****Includes all building categories with moderate to complete damage

Table 4-18 Critical Facilities

Classification	**Total**	**Least Moderate Damage >50%**	**Complete Damage > 50%**	**Functionality > 50% at day 1**
Hospitals	0	0	0	0
Schools	15	0	0	15
EOC's	0	0	0	0
Police Stations	6	0	0	6
Fire Stations	2	0	0	2

Table 4-19 Debris Generated (thousands of tons)/Loads to Remove Debris

Debris Generated	8
Loads (25 tons per load)	320

Table 4-20 Fire Following Event, Population Exposed, and Building Stock Exposed
No post-quake fire population or building stock has been identified.

Part 5. Capabilities Assessment

Within the SEUALG region, local governments have a diverse and strong capability to accomplish hazard mitigation. The purpose of this section is to analyze gaps and potential capability weaknesses for local level jurisdictions in the region. This assessment analyzes current capacity to mitigate the effects of natural hazards and emphasizes the positive capabilities that should be continued. The following areas were assessed to determine mitigation capabilities:

1. **Local Organizational and Technical Capability**
2. **Policy and Program Capability**
3. **Fiscal Capability**
4. **Political Willpower**
5. **Legal Authority**
6. **Political Willpower**

1. Local Organizational and Technical Capability

Only a handful of communities in the Southeastern region have fulltime professional staff of any kind. In many cases a limited tax base means that hiring full time professional staff in the smaller cities and towns is financially unfeasible. Often these smaller communities rely on local volunteers or elected and appointed officials to perform many of the tasks normally handled by professional staff. It is not uncommon for volunteer city council persons or planning commissioners to carry out assigned tasks of emergency management, grant writing or long range planning. Professional staff members at SEUALG (and each of the four counties to some degree) help provide some technical and planning assistance to these smaller communities. Staffing capacity and funding often limit this regional assistance. As funding allows, some communities are able to contract for professional services from private consultants (Table 5-1).

While a few of the cities have a full-time police and fire chiefs, most do not have staffs that are, for the most part, dedicated fulltime to other emergency management related tasks (Table 5-2). And even though each of the counties has an emergency manager, all of these individuals have other responsibilities in addition to core emergency management functions.

Table 5-1 State and Regional Hazard Mitigation Resources

Agency/Group	Description
Utah Div. of Emergency Services and Homeland Security	Training, technical assistance and funding.
Utah League of Cities and Towns	Training, technical assistance and planning assistance
Utah Geologic Survey	Technical assistance, plan review
Southeastern Utah Association of Local Governments (SEUALG)	Technical assistance, plan review, Community Development Block Grants.
Southeastern Utah Health Department	Emergency preparedness and response. Homeland security planning.
Utah Association of Conservation Districts	Technical assistance and planning assistance.
Utah Highway Patrol	Situation and damage assessment -- provide transportation resources for movement of state personnel, supplies, and equipment to include air and ground reconnaissance, and traffic control.

College of Eastern Utah	Information resource in dealing with drought, winter storms, summer storms etc. in relation to agriculture, environment, water resources, etc. Assist with damage assessment related to agriculture
College of Eastern Utah San Juan Center	Information resource in dealing with drought, winter storms, summer storms etc. in relation to agriculture, environment, water resources, etc. Assist with damage assessment related to agriculture
University Extension Service (Utah State University)	Damage assessment related to agriculture
Army Corps of Engineers	Water and dam management within the county. Provide technical expertise
State Fire Marshal	Hazmat route utilization; HAZMAT technical assistance; situation and damage assessment.
Utah Division of Wildlife Resources	Technical assistance; debris removal from recreational facilities; facility improvements; situation and damage assessment.
State Radio Communications	Exercise readiness of warning systems and communication support.
Department of Agriculture	Assists with situation and damage assessment; coordination with USDA; HAZMAT technical assistance; state land use program.
Department of Workforce Services	Situation assessment and administration of disaster unemployment assistance programs.
State Historical Society	Project screening and situation assessment.

Table 5-2 Local Level Hazard Mitigation Capability

Jurisdiction	**Professional Staffing (e.g. City Manger, Engineer, Planner)**	**Technical Capacity (In House)**
Carbon County	County Emergency Management Coordinator, County Planner, Public Works, Road Department, Building Inspector	GIS Staffing and equipment
East Carbon City	City Clerk, Recorder, Police Chief, Fire Chief	None
Helper City	City Clerk, Recorder, Police Chief, Fire Chief	None
Price City	City Administrator, Public Safety, Police Chief, Fire Chief, Public Works	None
Scofield Town	Volunteer Fire Department	None
Sunnyside City	City Clerk, Recorder, Police Chief, Fire Chief	None
Wellington city	City Clerk, Recorder, Police Chief	None

Emery County	County Emergency Management Coordinator, Planner, Public Works, Road Department, Building Inspector	GIS Staffing and equipment
Castle Dale City	City Clerk, Recorder, Fire Chief	None
Clawson Town	Volunteer\contracted consultant	None
Cleveland Town	City Clerk, Recorder, Fire Chief	None
Elmo Town	Volunteer\contracted consultant	None
Emery Town	City Clerk, Recorder, Fire Chief	None
Ferron City	City Clerk, Recorder, Fire Chief	None
Green River City	City Clerk, Recorder, Fire Chief	None
Huntington city	City Clerk, Recorder, Fire Chief	None
Orangeville City	City Clerk, Recorder, Fire Chief	None
Grand County	County Administrator, Sheriff, Planner, Public Works, Building Inspector	Some GIS Capability
Moab City	City Manager\Planner, Police Chief, Fire Chief	Some GIS Capability
San Juan County	County Administrator, Sheriff, Public Works, Road Department, Building Inspector	Some GIS Capability
Blanding City	City Manager\Planner, Police Chief, Fire Chief	Some GIS Capability
Bluff Town	Volunteer\contracted consultant	None
Monticello City	City Manager\Planner, Police	None

2. Policy and Program Capability

Most of the municipalities in the Southeastern region have an adopted General Plan as required by state code. Although many communities have recently updated their General Plan, many are very outdated and have not been revised in years. Generally speaking, if these plans address natural hazards at all, it is usually limited to flood related hazards.

All of the municipalities have an adopted zoning ordinance. Again, often these ordinances are outdated and often are not consistent with the jurisdiction's General Plan. Most zoning ordnances do not address natural hazards in any way. A few communities have a "sensitive area" or "hazard area" overlay zone. All communities issue building permits and enforce local building codes. Often this service is contracted for with the county.

Of the nineteen municipalities and four counties, seventeen are participating in the National Flood Insurance Policy program (Appendix D). However, much of the flood map data is inaccurate and/or out of date.

Building Codes

International and national building codes have been adopted by all jurisdictions in the region. These codes are constantly in review for reasonable preparedness for disasters. Locally, building officials lobby for additions or exceptions to international and/or national building codes according to local conditions. Most insurance policies rely on the international and national building code standards for assurance.

The Insurance Services Office, Inc performs Building Code Effectiveness Grading Reports (BCEGS). The program implemented in 1995 assesses the building codes in effect in a particular community and how well the community enforces its building codes. The BCEGS program assigns each municipality a BCEGS grade of 1 to 10 with one showing exemplary commitment to building code enforcement. Insurance Services Inc. (ISO) developed advisory rating credits that apply to ranges of BCEGS classifications 1-3, 4-7, 8-9, 10. ISO gives insurers BCEGS classifications, BCEGS advisory Credits, and related underwriting information. The concept is that communities with effective, well-enforced building codes should sustain less damage in the event of a natural disaster, and insurance rates can reflect that. The prospect of lessening natural hazard related damage and ultimately lowering insurance costs provides an incentive for communities to enforce their building codes rigorously. FEMA also uses these scores in their competitive grant programs giving a higher ranking to those projects with lower scores. The following table highlights the BCEGS scores for Wasatch Front Region jurisdictions (Table 5-3).

Table 5-3 Building Code Effectiveness Grading Reports

Community	**County**	**BCEGS Classification**		**Date**
		Residential	**Commercial**	
Blanding	San Juan	4	4	2002
Carbon County	Carbon	4	4	2001
Emery County	Emery	4	4	2002
Ferron City	Emery	5	5	1998
Grand County	Grand	3	3	2001
Huntington	Emery	3	3	2001
Moab City	Grand	4	4	1997
Price City	Carbon	3	3	2001
San Juan County	San Juan County	4	4	2002

Community Ranking System

Communities that regulate development in floodplain are able to participate in the National Flood Insurance Program (NFIP). In return, the NFIP makes federally backed flood insurance policies available for properties in the community. The Community Rating System (CRS) was implemented in 1990 as a program for recognizing and encouraging community floodplain management activities that exceed the minimum NFIP standards. There are ten CRS classes. Class 1 requires the most credit points and gives the largest premium reduction. Class 10 receives no premium reduction. Refer to Table 5-4 for a list of the participating communities.

Table 5-4 Community Ranking System Scores for WFRC

Community Name	**Entry Date**	**Effective Date**	**Class**	**% Discount for SFHA***	**% Discount for Non-SFHA**
Moab City, Grand County	04/01/01	04/01/01	9	5	5

***** Special Flood Hazard Area

3. Fiscal Capability

Every county in the SEUALG region has very limited fiscal capability to implement hazard mitigation strategies. This is due to the four county planning areas having a small population and tax base. In Utah, almost 70 percent of the land area remains in federal control, with only about 21 percent privately owned. In the Southeastern region those percentages are typically much higher. Between federal and state ownership, counties in the southeast region are essentially "sharecroppers" of the land. The federal and state governments in turn, restore a small portion of these revenues to the local governments in the form of grants and subsidies.

Furthermore, the State of Utah spends more money than it takes in for three of the four counties (Carbon, 1.44; Emery, 1.51; and San Juan, 4.03) in the Southeast region. Only Grand County receives less in state funding than it sends to the state. In fact, San Juan County ranks as number three in the state for ratio of dollars spent to dollars received by the state (Carbon is ranked 15th and Emery 16th). In each case the majority of dollars are spent on K-12 education (See *Redistributing Utah's Resources: Burdens and Benefits Around the State*. Research Report Number 657, May 2003, Utah Foundation).

Given the above information it is highly unlikely that counties in the Southeastern region could afford to provide the local match, without state support, for the available hazard mitigation grant programs. Considering the current budget situation at both the State and local government level, combined with the apparent increased reliance on local accountability by the Federal government, this is a significant and growing concern for our region.

Under the Disaster Mitigation Act of 2000, FEMA has made special accommodations for "small and impoverished communities", who will be eligible for a 90% Federal share, 10% non-Federal cost split for projects funded through the Pre-Disaster Mitigation Grant Program. Unfortunately, according to the current Interim Final Rule for Section 322 of the Act, none of the counties in our region will qualify as a small and impoverished community. The definition is restricted to "communities of 3,000 or fewer individuals that is identified by the State as a rural community."

4. Political Willpower

Most area residents are quite knowledgeable about the potential hazards that faces their community and through the pre-disaster mitigation planning process; they have become more familiar with the principles of mitigation. It is strongly believed that such efforts within the community have created a greater sense of awareness among local residents, and that hazard mitigation is a concept that they are beginning to readily accept and support.

Because of this fact, coupled with the region's history with natural disasters, it is expected that the current and future political climates are favorable for supporting and advancing future hazard mitigation strategies.

Part 6. Risk Assessment

A. Hazard Identification

The first step in risk assessment is identifying the hazards that could affect the Southeastern region. Hazard identification addresses the geographic extent and intensity / magnitude of a hazard as well as the probability of its occurrence. Hazard identification was initiated through an extensive process that utilized the following:

- Core Planning Team
- Local Planning Team
- Technical Team
- Community and Public individuals
- Elected Officials
- City and County Agencies
- Utah Department of Emergency Services and Homeland Security
- Utah Geological Survey
- Utah Automated Geographic Reference Center

The natural hazards in the table below have the possibility of affecting each county within the SEUALG region. The identification process for each county and participating jurisdictions utilized those natural hazards that consistently affected each county prior to and during the planning process based on history of occurrences, future probability, and risk (Table 6-1). Table 6-1-1 identifies those hazards on a county level for easy reference.

The Wasatch Front Regional Council with help from the SEUALG and local GIS officials, created maps that identified the location of critical facilities and the municipalities affected by each identified hazard. Initial data from this study was also used to determine those hazards that presented the greatest risk to each of the counties. The geographic extent is identified in the maps at the end of every county section. The hazard intensity/ magnitude and probability is also profiled in each county section.

Within each of the four counties, there are several jurisdictions. All of these jurisdictions contributed to the risk assessment analyses performed for each county when located within a hazard boundary. Within each county section refer to the "description and location of extent" paragraph detailing this risk assessment. Earthquake, Drought, and Severe Weather are considered regional hazards and have been profiled as such. Please refer to Part 4 Regional Data for more information.

Table 6-1 Hazard Identification

Hazard	How Identified	Why Identified
Mapped Hazards		
Earthquake	• Review of County Emergency Operations Plans • Review of past disaster declarations • Input from City and County Emergency Operations Managers, USGS, UGS, Utah DESHS, and community members	• Utah is predicted, 1/5 chance, to experience a large earthquake within the next fifty years. • Utah experiences approximately 13 earthquakes a year with a magnitude over 3.0. • Can create fire, dam failure, flooding, hazardous materials incident, transportation, and communication breakdowns. • Southeastern Utah has recorded earthquakes in the past.

Landslide	• Input from City and County Emergency Operations Managers, USGS, UGS, NCDC, Utah DESHS, and community members	• Have caused damage in the past to residential and commercial infrastructure. • Can be life threatening. • Generally occur in known historical locations, therefore risks throughout much of Southeastern Utah. • Would like to increase community awareness.
Wildfire	• Review of County Emergency Operations Plans • Review of Community Wildfire Plans • Input from County Emergency Managers, Utah DESHS, Utah FFSL, Utah FS, NWS, FEMA, and local community members	• Serious threat to life and property. • Increasing threat due to urban sprawl in URWIN areas. • Secondary threat associated with flooding, drought, and earthquake. • Most of Utah is at risk including the Southeastern Utah counties. • Additional funding and resources offered by local and state agencies to reduce risk. • Would like to increase community awareness.
Problem Soils	• Review of County Emergency Operations Plans • Input from community members, Utah, DESHS, and UGS • Researched historical data	• Related to subsequent effects from earthquakes that happen in Southeastern Utah. • Have affected infrastructure and local economy in the past. • Southeastern Utah has a significant amount of problem soils.
Dam Failure	• Review of County Emergency Operations Plans • Input from community members, Utah DWS, Dam Safety Section, Utah DESHS • Review of inundation maps	• Can cause serious damage to life and property and have subsequent effects such as flooding, fire, debris flow, etc. • Many reservoirs located in the four county region of Southeastern Utah. • Threat to downhill communities. • Would like to increase community awareness. • Would like to incorporate mitigation measures into existing plans to help serve local residents.
Unmapped Hazards		
Flood/ Flash Flood	• Review of past disaster declarations • Input from City and County Emergency Operations Managers, Utah DWS, UGS, Utah Army Corps of Engineers, Utah DESHS, and community members • Review of Flood Insurance Studies, Floodplain maps, and Flood Insurance Rate Maps	• Several previous incidents have caused severe damage and loss of life. • Many of the rivers and streams are located near neighborhoods. • Many neighborhoods are located on floodplains, alluvial fans. • Due to Utah's geology and climate cloudburst storms and heavy precipitation cause flash flooding throughout most of Southeastern Utah.

Drought	• Review of County Emergency Operations Plans • Input from community members, Utah DESHS, NWS, NCC, and NCDC	• Affects local economy and residents. • Affects water reservoirs' levels and therefore culinary, irrigation, and municipal water. • Currently in a drought period. • Secondary threat associated with wildfire. • Utah's is the nation's second driest state. • Can result in loss of farming resources and livestock.
Infestation	• Review of County Emergency Operations Plans • Input from community members, Utah FFSL, Utah State University Extension Service, Idaho Forest Health Protection Agency, Boise State Foresters, and Utah Dept. of Agriculture	• Consistently affects this region. • Declined forest health and agriculture losses. • Previous experiences have affected Southeastern Utah. • Affects local economy. • Destruction can be severe and is very costly to mitigate. • Need a better understanding of ways to mitigate and prepare. • Secondary threat of drought.
Severe Weather (Severe Storm, Avalanche, Lightning)	• Review of County Emergency Operations Plans • Review of past disaster declarations • Input from City and County Emergency Operations Managers, Utah Avalanche, Forecast Center, Utah Department of Transportation, and community members, National Weather Service	• Damage to communities, homes, infrastructure, roads, ski areas, and people. • Can cause property damage and loss of life. • Affects local economy and vegetation. • Lightning is the number one cause of death in Utah. • Can be costly to recover from. • Affects the young and old more severely.

Table 6-1-1 County Hazard Identification

	Carbon County	Emery County	Grand County	San Juan County
Earthquake	X	X	X	X
Landslide	X	X	X	
Wildland Fire	X		X	X
Problem Soils	X		X	
Dam Failure	X	X		X
Flood/ Flash Flood	X	X	X	X
Drought	X	X	X	X
Infestation	X			X
Severe Weather	X	X	X	X

The hazard identification process was aided through the use of FEMA How to Guidance documents, FEMA 386-1,2,3,7 FEMA Post Disaster Hazard Mitigation Planning Guidance DAP-12, Disaster Mitigation Act of 2000, 44 CFR Parts 201 and 206, Interim Final Rule, and FEMA Region VIII Crosswalk. The risk assessment process also utilized assistance from local Wasatch Front region GIS departments using the best available data.

B. Hazard Profile

This section describes the causes and characteristics of each identified hazard including it's severity or magnitude (as it relates to the percentage of the jurisdiction that can be affected), probability, conditions that make the area prone to the hazard, a hazard history, and a map of the hazard's geographic location or extent. The hazards were profiled based on history of occurrence, local input, county emergency operations plan's, and county master or general plans, scientific reports, historical evidence, and hazard analysis plans. A risk assessment "Hazard Profile" table was created that highlights the above-mentioned materials in each of the county portions of the plan introducing each identified hazard.

In determining hazard magnitude a scale was used to identify the level of damage on a countywide basis from Catastrophic to Negligible (Table 6-2).

Table 6-2 Hazard Profile

	Jurisdiction Affected	**Risk**
Catastrophic	More than 50%	Extreme or High
Critical	25-50 %	Moderate
Limited	10-25%	Moderate
Negligible	Less than 10%	Low

The probability of a hazard event was determined through the amount of risk to the county. The probability or likelihood of an occurrence is categorized into four categories: Highly Likely, Likely, Possible, and Unlikely.

The geographical extent or location of the community that would be affected has been identified in the mapping portion of each county when plausible.

Hazard history has been identified and recorded and is located in Section F of each county section.

Maps were created using GIS software to identify the location and extent of each identified hazard area. Drought, Flood, Infestation, and Severe Weather maps were unable to be created due to the lack of data, or the nature and geographic extent of these hazards, therefore, hazard profiles will be in narrative form only.

The following Risk Assessment maps were created for each county:

- Earthquake Epicenters and Fault Zones
- Landslide
- Wildfire
- Problem Soil
- Dam/ Reservoir Sites

C. Vulnerability Analysis

The vulnerability analysis is based on asset identification and potential loss estimates for those jurisdictions located within identified hazard areas.

Asset Identification

The vulnerability analysis combines the data from each of the hazard profiles and merges it with community asset information to analyze and quantify potential damages from future hazard events. The asset inventory identifies buildings, roads, and critical facilities that can be damaged or affected by the hazard events. Critical facilities are of particular concern because of the essential products and/or services they provide to the general public. These critical facilities can also fulfill important public safety, emergency response, and/or disaster recovery functions. The critical facilities identified in this plan can include hospitals, police and fire stations, schools, communication facilities, utility companies, and water and wastewater treatment plants. In order to assess where and to what extent the identified hazards will affect the assets of each county, the locations of assets were identified and correlated with the mapped hazards using GIS software. Identified assets are discussed in detail within each county section. For a complete list of critical facilities for each county refer to Appendix C.

Potential Loss Estimates

Potential dollar losses were estimated using the same method indicated above, therefore estimates were completed for existing infrastructure only. When data permitted, structure, contents, and function of the identified vulnerable infrastructure were incorporated into the vulnerability assessments. Describing the vulnerability in terms of dollar losses provides the community and the state with a common framework from which to measure the effects of hazards on assets.

We were unable to analyze future planned development due to the lack of available data in GIS format. However, countywide development trends have been identified and are addressed within each county's chapter.

The core planning team and local planning team members estimated potential losses from the identified hazards by using the methodology explained in the FEMA document "Understanding Your Risks: Identifying Hazards and Estimating Losses", Utah DESHS historical data, and GIS data.

The information sources used to complete the vulnerability analysis and loss estimates include county GIS departments, county assessors offices, HAZUS MH data, the Utah Automated Geographic Reference Center (AGRC), and Census 2000 data. Parcel data, and Census 2000 data were used to identify household types and numbers as well as the number of residents within the identified boundary. This data was compiled into GIS layers that were used as overlays to identify critical facilities, municipalities, roads, and residents. Utah Department Of Transportation (DOT) provided the base map layer to aid in the risk assessment. The assets that have been identified are based on the best available data at the time of the compilation of this plan in GIS form.

Flood loss estimates were unable to be created due to the lack of digitized floodplain datasets. Future natural hazard mitigation planning would like to include flood losses in the future by using up to date flood maps. The Utah Department of Emergency Services and Homeland Security at this time recognizes the need for updated data and is underway to initiate that change.

Methodology

Geographic Information System (GIS) software was used as the basic analysis tool to complete the hazard analysis for the Southeastern Utah Association of Governments Pre-disaster Mitigation Plan. For most hazards a comparison was made between digital hazard data and Census 2000 demographic information. Statewide digital data was obtained from Utah Automated Geographic Reference Center (AGRC) for the following hazards: landslides, problem soils, quaternary faults, wildfire, dam locations, and epicenter locations. The vulnerability assessment for each county estimates the number of homes, businesses, infrastructure and population vulnerable to each hazard and assigns a replacement dollar value to

residential structures in each hazard area. The value of residential housing was calculated using estimated average residential housing values for each county. All the analysis takes place within the spatial context of GIS. With the information available in spatial form, it is a simple task to overlay the natural hazards with census data to extract the desired information.

The methodology used to determined vulnerability to each hazard -- earthquakes, problem soils, landslides, and wildfire within the study area was almost identical. The number of households and population vulnerable to each hazard was determined using Block Data from the Census 2000 data. Parcel data was unavailable. The Block Data from the Census 2000 database was intersected with each of the mapped hazard layers in order to determine the number and location of residential housing units and the population at risk from each hazard. The methodology used assumes an even distribution of residential housing units and population across each census block. Point data from HAZUS MH was used to determine the number of businesses and the annual sales of each business in each hazard area.

In addition to the above methodology, earthquake was profiled using HAZUS MH, which is shorthand for Hazards United States. The HAZUS MH Earthquake Model is designed to produce loss estimates for use by federal, state, regional and local governments in planning for earthquake risk mitigation, emergency preparedness, response and recovery. The methodology deals with nearly all aspects of the built environment, and a wide range of different types of losses.

The number of acres of extreme, high, and moderate wildfire; acres of historically active landslides; acres within earthquake fault zones; and acres of problem soils were determined for each city and all unincorporated areas. Once the acre total was identified it was overlaid on the Census Block data to determine the total number of homes impacted. This figure was then multiplied by the average housing value as reported by the county Assessor's office to determine the total value of potential loss. The County Assessor's data used year 2000 average housing values.

County	**2000 Average Estimated Residential Sales Price**
Carbon	$78,637
Emery	$82,909
Grand	$123,751
San Juan	$123,751

In the case of wildfire and earthquake, the value of the land (20% of total) was subtracted from the totals reported in the vulnerability tables. Rationale for the 20% discount is that in the event of a wildfire or an earthquake land is usually left more useful than after a landslide. Also note that content values are not included in the potential loss analysis. Content values could raise the potential loss numbers for housing by approximately 50%.

The potential impact of natural hazards on transportation and utilities was determined in a similar method as described above. Roads and utilities were overlaid on the hazard areas and the impacted utility and road segments were inventoried. Once the length of vulnerable infrastructure was determined it was multiplied by cost estimate information from HAZUS MH and the Utah Department of Transportation. These costs include:

Item	**Cost per Mile**
Local Roads	2,000,000
State Highways	2,413,500
US Highways	2,413,500
US Interstates	3,600,000
Power Lines	48,280
Gas Lines	241,390

In addition to linear infrastructure, point data from HAZUS MH and state GIS including critical facilities, dams, care facilities, schools, power generation facilities, and substations was analyzed to determine if the feature was within a hazard area.

Limited availability of digital data represented a problem in completing the vulnerability assessment. Potential loss numbers were only determined for earthquakes, landslides, problem soils and wildfires in this plan. Additional limitations to the above described analysis method include:

- Assuming random distribution
- Limited data sets for water, gas, and electrical resulting in incomplete numbers for these features
- Lack of digital parcel data from the county assessors' offices
- No digital data for dam failure inundation, flood plains, or infestation
- Relied on state wide data not intended for manipulation at the scale it was used
- Data was not field checked, resulting in an analysis wholly dependent on accuracy of data
- Meta data was lacking on some of the used data sets

In terms of hazard mapping, this document contains simple maps created to provide a graphical illustration of hazard location. These maps are done at a scale, which allows them to fit on a standard letter sized page. Larger maps can be plotted out upon request. Data manipulation and maps were created as a planning tool to be used by interested persons within the Southeastern Utah Association of Governments and the jurisdictions the AOG serves. Information from these maps must not take the place of accurate field verified mapping from which ordinances need to be based off.

Effort to analyze hazards related to potential development areas was also addressed where applicable. Identifying hazards to potential development is very difficult. This study merely identifies areas, which need additional research before development should be allowed. No viable source of data exists for this study area to facilitate analysis of future development. Limited zoning data was available, but this data does not necessarily indicate which areas will be developed and which will not.

D. Mitigation Goals, Objectives, Actions

Using the findings from the risk assessment and the capabilities assessment as a guide several mitigation actions were identified that would benefit each jurisdiction. Each action has been formalized and placed into this plan in each of the county mitigation sections. These actions were identified in the planning group meetings, which included input from the core planning team, local planning team, state and local agencies, county government, and city and county residents.

Within the Southeastern Association of Local Government's all four counties participated in the Mitigation Workbook set forth by the Utah Division of Emergency Services and Homeland Security. Each county chose a task leader to create a workgroup made up of local elected officials and community members to identify local mitigation strategies. Once the workgroup was setup they were given training and direction for completing the workbook. Mitigation strategies were pulled from existing plans and programs and those projects already identified were included in this plan. Other strategies were also included that met the STAPLEE process. Some of these strategy ideas were generated using a general mitigation strategies menu found in Appendix B. The completed workbook was then given to the Wasatch Front Regional Council for review and to incorporate into the plan.

Goals and objectives were developed in a working session between the above-mentioned figures with a period provided for comment and revision. Each of the jurisdictions identified mitigation actions based on the identified goals and objectives with particular emphasis on new and existing buildings and infrastructure. These actions are included in Section G of every county portion of this plan. The mitigation actions identify the responsible agency, the funding source, timeline, background, and their priority. Actions were selected using the information obtained from the capabilities assessment, which identified existing programs and shortfalls related to mitigation activities. The actions were prioritized based on the STAPLEE method identified in the FEMA How to Guides. Prioritization emphasized the effectiveness of the actions with respect to their cost, as well as their social, technical, administrative, political, legal, environmental, and economic effects. Each of the actions were judged and ranked against these criteria and assigned the priority of High, Medium, or Low.

E. Hazard Description

Each of the natural hazards that could affect Utah, including the Southeast region, has been described below. These are general descriptions about each hazard to give an idea of what, why, when, and how the hazards occur.

1. Earthquake

According to Sandra Eldridge, (Utah Natural Hazards Handbook 4-15), an earthquake is the result of "…sudden breakage of rocks that can no longer withstand the stresses that build up deep beneath the earth's surface"(5). The energy that is released is abrupt shaking, trembling or sudden motion in the earth and rocks that break along faults or zone of weakness along which the rocks slip. Seismic waves are then transmitted outward and also produce ground shaking or vibrations in the earth. The Richter scale measures the magnitude of earthquakes on a seismograph. An earthquake with a Richter magnitude 6 is 30 times more powerful than a Richter magnitude 5. A Richter magnitude 7 is 1000 times more powerful than a Richter magnitude 5. In order for humans to feel an earthquake is usually needs to be at least a magnitude 2.0. In order for significant damage to occur an earthquake needs to be at least a magnitude of 5.5 or greater. The amount of damage that occurs from an earthquake depends on soil type, rock type, ground-water depth, and topography. Other factors include the type of construction in an area and the population density. The Utah region records approximately 700 earthquakes a year, and an average of 13 of those are of magnitude 3.0 or greater. A magnitude 5.5 to 6.5 earthquake occurs in Utah every 7 years (4-5).

Locations and Activity: Faulting can be evident on the earth's surface or not evident at all, therefore earthquakes are believed to be able to occur anywhere in Utah (6-8). The earthquake history of WFRC is complicated by the fact that we have not had a large recorded earthquake during recorded historical time. The geographic area comprising WFRC last produced a major earthquake, approximately 1,350 years before present. Yet, when looking at the region, the potential for a large earthquake exists when one considers that "since 1850 at least 16 earthquakes (excluding aftershocks) of magnitude 6.0 or greater have occurred within the ISB" (Eldredge 6). The greatest earthquake hazard is considered to be in the areas surrounding the Wasatch, East Cache, East Bear Lake, Bear River, Hansel Valley, Northern Oquirrh, West Valley, and East Great Salt Lake fault zones. Other areas of significant hazard along the southern portion of the ISB include Hurricane, Paragonah, and Sevier faults. The other significant hazard areas in Central Utah are the Stansbury, Joes Valley, and Gunnison faults (7). On the Wasatch fault, the segments between Brigham City and Nephi the "composite recurrence interval for large surface-faulting earthquakes (magnitude 7.0 to 7.5) is 395 ± 60 years.

Average number of earthquakes occurring in Utah

Magnitude	Frequency
≥ 3.0	6 per year
≥ 4.0	1 per year
≥ 5.0	1 every 4 yrs
≥ 5.5	1 every 10 yrs
≥ 6.0	1 every 20 yrs
≥ 6.5	1 every 50 yrs
≥ 7.0	1 every 150 yrs

≥ = greater than or equal to

(Source: University of Utah Seismograph Stations)

Chart 1.1 Average number of earthquake occurring in Utah.

The most recent surface-faulting earthquake on the Wasatch fault occurred 400 years ago on the Nephi segment" (Eldredge 7). The two largest historical earthquakes to occur in Utah were the Richfield earthquake of 1901, with a magnitude of 6.5 and the Hansel Valley earthquake of 1934 with a magnitude of 6.6.

The Hansel Valley earthquake produced MM intensities of VIII in Salt Lake City, with numerous reports of broken windows, toppled chimneys, and structures twisted on their foundations. A clock mechanism weighing more than 2 tons fell from the main tower of the Salt Lake City County Building and "crashed through the building" The only death that occurred during the event was caused when the walls of an excavation collapsed on a public-works employee south of downtown Salt Lake City (Qtd. in Lund 20).

Utah's most damaging earthquake was of a smaller magnitude (5.7), which occurred near Richmond within Cache Valley during 1962. This earthquake damaged over 75 percent of the houses in Richmond, as well as roads and various other structures. The total damage in 1962 dollars was about one million dollars.

The Utah Seismograph Stations records about 700 earthquakes each year; only about 13 of these have a magnitude of 3.0 or larger.

"*Earthquakes in 1909, 1914, and 1943 produced MM intensities in Salt Lake City of up to VI, and earthquakes in 1910, 1949, and 1962 had MM intensities of VII in Salt Lake City. Damage produced by these events included broken windows, cracked walls, fallen plaster, toppled chimneys, and buildings shifted on their foundations. The 1949 earthquake also ruptured a water main causing loss of water to a portion of the city"* (Qtd. in Lund 20).

On average a moderate, potentially damaging earthquake (magnitude 5.5 to 6.5) occurs in Utah every 7 years. The history of seismic activity in Utah and along the Wasatch Front suggests that it is not a matter of "if" but when an earthquake will occur.

Secondary Hazards: Associated earthquake hazards include ground shaking, surface fault rupture and tectonic subsidence, soil liquefaction, flooding, snow avalanches, dam failure, fire, and slope failure.

Ground Shaking: Ground shaking is caused by the passage of seismic waves generated by an earthquake. Shaking can vary in intensity but is the greatest secondary hazard because it affects large areas and stimulates many of the other hazards associated with earthquakes. The waves move the earth's surface laterally and horizontally and vary in frequency and amplitude. High frequency, small amplitude waves cause more damage to short, stiff buildings. Low frequency, large amplitude waves have a greater effect on high-rise buildings. The intensity depends on geologic features such as bedrock and rock type, topography, and the location and magnitude of the earthquake. Other significant factors include ground water depth, basin shape, thickness of sediment, and the degree of sediment consolidation. Moderate to large earthquake events generally produce trembling for about 10 to 30 seconds. But aftershocks can occur erratically for weeks or even months after the main earthquake event (7-8).

Surface Fault Rupture and Tectonic Subsidence**:** Surface fault rupture or down dropping and tilting associated with tectonic subsidence can rupture the ground surface and in Utah the result is the formation of scarps or steep breaks in the slope. The Hansel Valley (1934) earthquake resulted in a surface displacement of approximately 1.6 feet. Surface faulting in the central segments of the Wasatch fault are expected to have the highest potential. Also earthquakes having a magnitude of 6.5 or greater could result in surface faulting of 16 to 20 foot high and 12 to 44 mile long break segments. Surface displacement generally occurs over a zone of hundreds of feet wide called the zone of deformation. Tectonic subsidence generally depends on the amount of surface fault displacement. The greatest amount will be at the fault and will gradually diminish out into the valley (8-10).

Soil Liquefaction**:** Liquefaction occurs when there is a sudden large decrease in shear strength of sandy soils caused by the collapse of the soils structure, in which the soil loses its bearing capacity, and also by a temporary increase in pore-water pressure, or water saturation during earthquake ground shaking. Liquefaction is common in areas of shallow ground water and sandy or silty sediments. Two conditions must be met in order for soils to liquefy; (1) the soils must be susceptible to liquefaction (sandy, loose, water-saturated, soils typically between 0 and 30 feet below the ground surface) (2) ground shaking must be strong enough to cause susceptible soils to liquefy (Lips). The result is soils that will flow even on the gentlest of slopes. Lateral spreading is a type of failure that results in surficial soil layers breaking up and moving, up to 3 feet or more, independently over the liquefied layer. On slopes more than 5 percent, flow failures can move miles up to 10s of miles per hour. On slopes less than 0.5 percent the bearing capacity will lessen and can cause buildings to settle or tip. No matter the slope percent ground cracking and differential settlement will occur. Liquefaction can also cause foundation materials to liquefy and fail and/or cause sand boils. Sand boils are deposits of sandy sediment ejected to the surface during an earthquake along fissures. Liquefaction can occur during earthquakes of magnitude 5.0 or greater (10-11).

Slope Failure**:** Ground shaking can cause rock falls and landslides in mountainous or canyon areas. Rock falls are the most common slope failure and can occur up to 50 miles away from a 6.0 magnitude earthquake. Landslides occur along benches in wet unconsolidated materials. During a 6.0 magnitude earthquake, landslides may occur within 25 miles of the source (11).

Flooding: “Flooding can happen due to tectonic subsidence and tilting, dam failure, seiches (waves generated in standing bodies of water) in lakes and reservoirs, surface-water diversion or disruption, and increased ground-water discharge”, According to the Natural Hazards Handbook 11.

Snow Avalanches: Avalanches could be triggered because of the associated ground movement. The most vulnerable areas include those that have steep terrain, high precipitation, high earthquake potential, and high population density. An example of this area in Utah would be the Wasatch Front (11-12).

Sensitive Clays: Sensitive clays are a soil type that losses strength when disturbed and result in liquefaction or collapse. The resulting type of ground failure is similar to liquefaction (12).

Subsidence: A settling or sinking of the earth’s crust in loose granular materials such as and gravel that do not contain clay. Western Utah is subject to this type of ground settlement (12).

Figures 6-1-1, 6-1-2, and 6-1-3 identify earthquakes with a Richter magnitude of 3.0 or higher and where in the County they are located between 1962 and 1993, courtesy of Kory Iman.

Figure 6-1-1

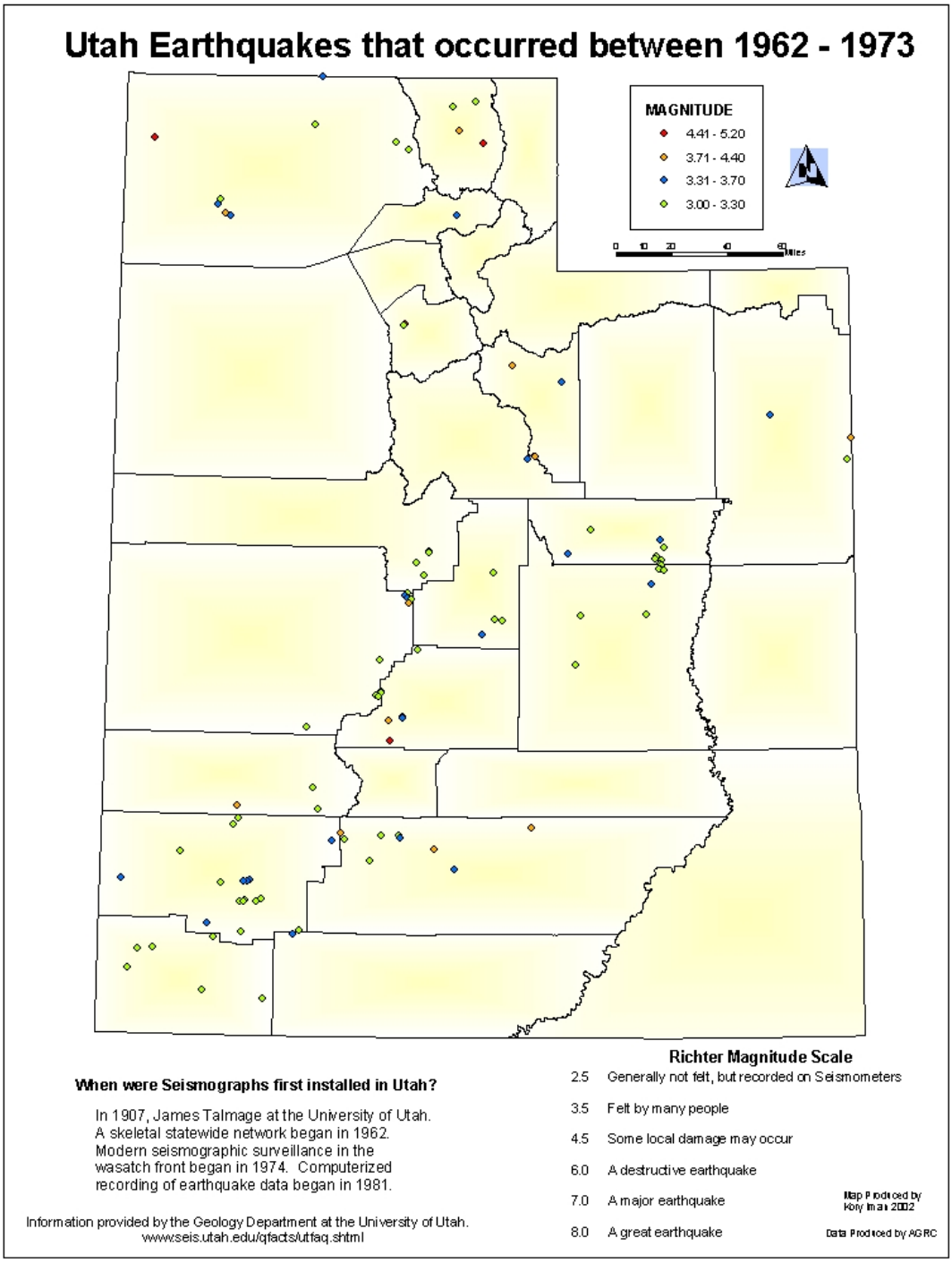
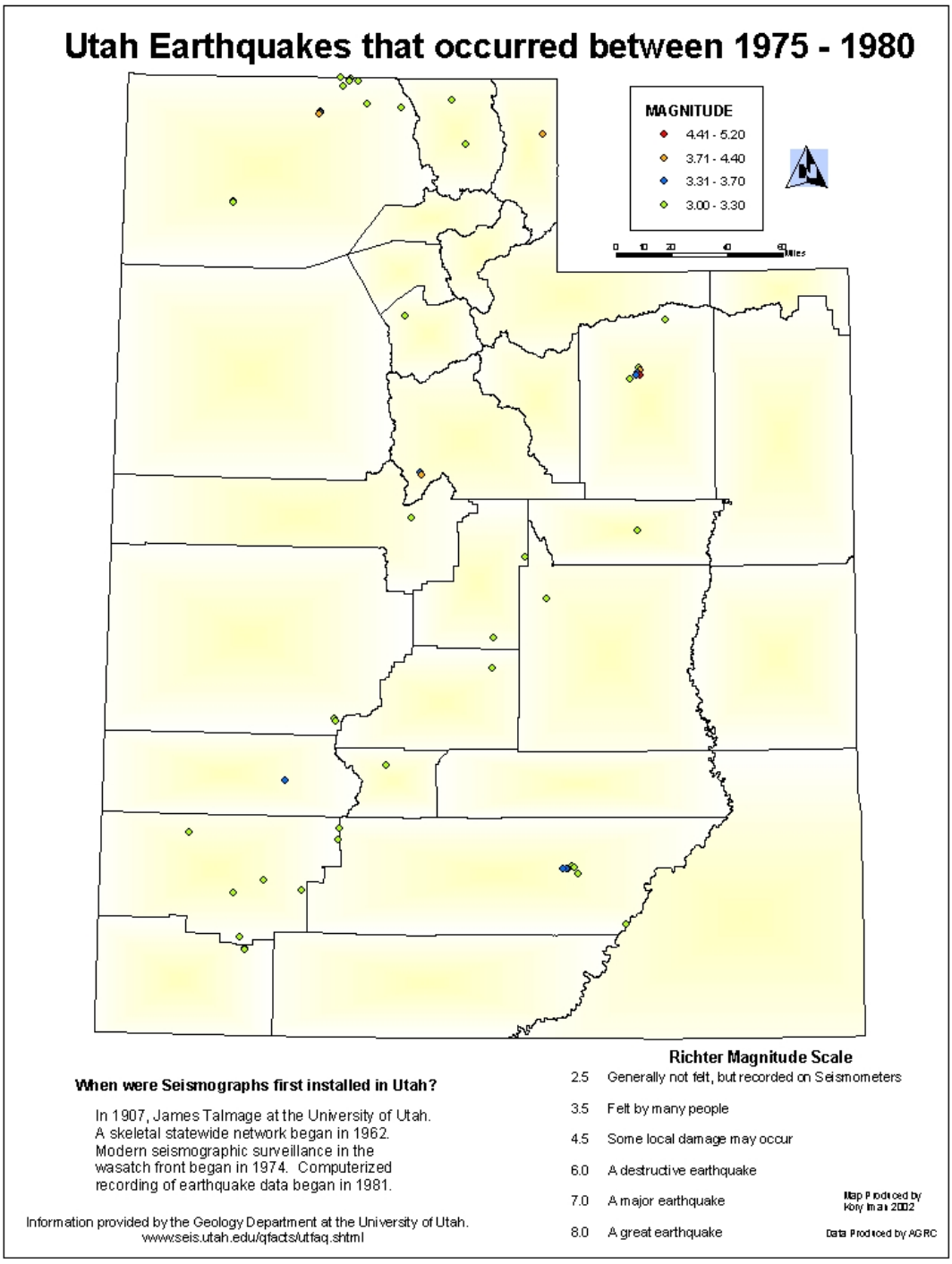

Utah Earthquakes that occurred between 1962 - 1973
MAGNITUDE
4.41 - 5.20
3.71 - 4.40
3.31 - 3.70
3.00 - 3.30
When were Seismographs first installed in Utah?
In 1907, James Talmage at the University of Utah.
A skeletal statewide network began in 1962.
Modern seismographic surveillance in the
wasatch front began in 1974. Computerized
recording of earthquake data began in 1981.
Information provided by the Geology Department at the University of Utah.
www.seis.utah.edu/qfacts/utfaq.shtml
Richter Magnitude Scale
2.5 Generally not felt, but recorded on Seismometers
3.5 Felt by many people
4.5 Some local damage may occur
6.0 A destructive earthquake
7.0 A major earthquake
8.0 A great earthquake
Map Produced by
Kory Imai 2002
Data Produced by AGRC

Figure 6-1-2


Utah Earthquakes that occurred between 1975 - 1980
MAGNITUDE
4.41 - 5.20
3.71 - 4.40
3.31 - 3.70
3.00 - 3.30
When were Seismographs first installed in Utah?
In 1907, James Talmage at the University of Utah.
A skeletal statewide network began in 1962.
Modern seismographic surveillance in the
wasatch front began in 1974. Computerized
recording of earthquake data began in 1981.
Information provided by the Geology Department at the University of Utah.
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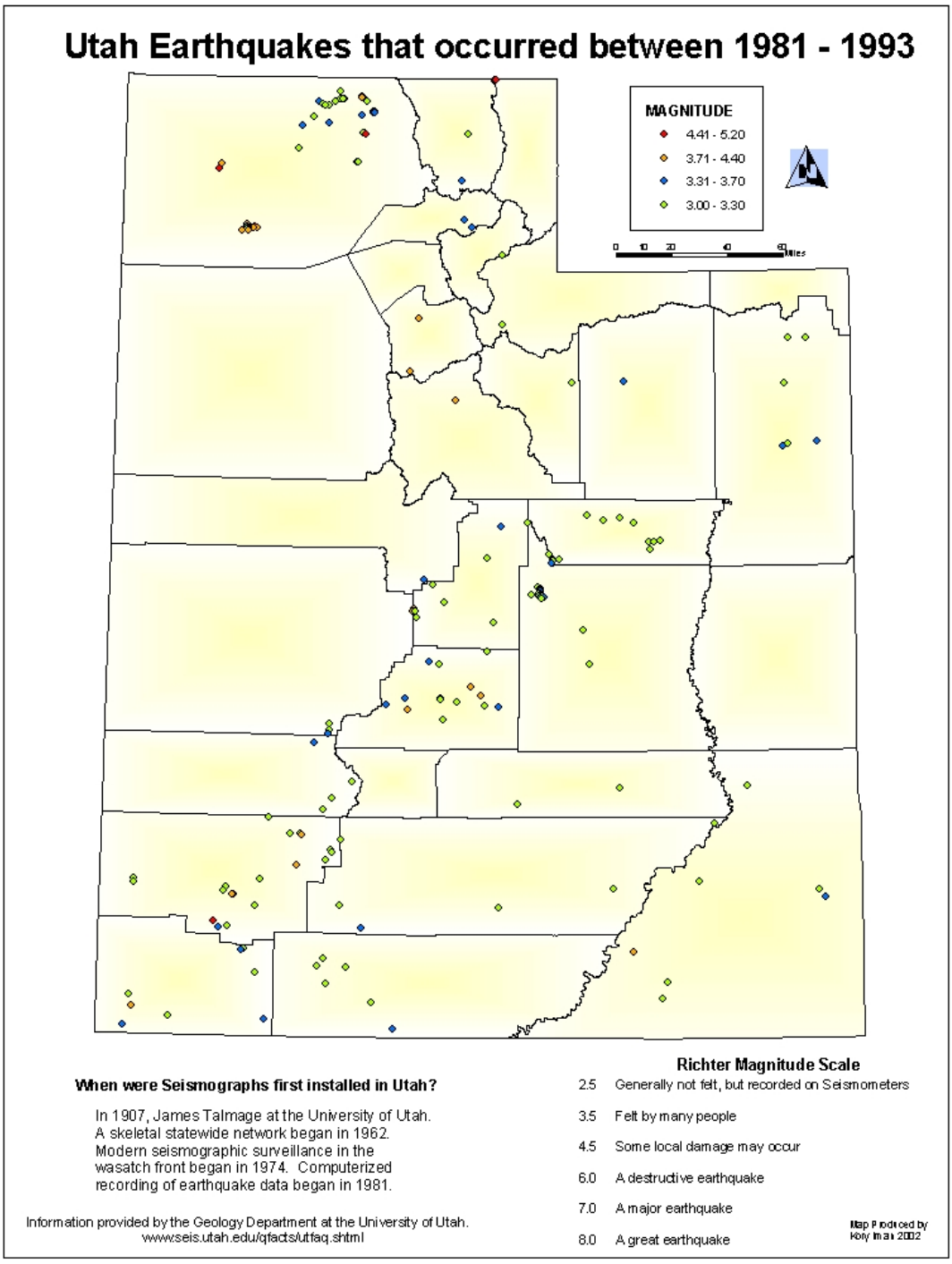
Richter Magnitude Scale
2.5 Generally not felt, but recorded on Seismometers
3.5 Felt by many people
4.5 Some local damage may occur
6.0 A destructive earthquake
7.0 A major earthquake
8.0 A great earthquake
Map Produced by
Kory Imai 2002
Data Produced by AGRC

Figure 6-1-3


Utah Earthquakes that occurred between 1981 - 1993
MAGNITUDE
4.41 - 5.20
3.71 - 4.40
3.31 - 3.70
3.00 - 3.30
When were Seismographs first installed in Utah?
In 1907, James Talmage at the University of Utah.
A skeletal statewide network began in 1962.
Modern seismographic surveillance in the
wasatch front began in 1974. Computerized
recording of earthquake data began in 1981.
Information provided by the Geology Department at the University of Utah.
www.seis.utah.edu/qfacts/utfaq.shtml
Richter Magnitude Scale
2.5 Generally not felt, but recorded on Seismometers
3.5 Felt by many people
4.5 Some local damage may occur
6.0 A destructive earthquake
7.0 A major earthquake
8.0 A great earthquake

2. Flood

It is important to note that flooding is a natural event for rivers and streams. Flood is determined to be the overflow of water onto land that is normally dry. Floods are related to an excess of snowmelt, rainfall, or failure of natural or engineered impoundments onto the banks and adjacent floodplains. Floodplains are lowland areas near river, lakes, reservoirs, oceans, and low terrain urban areas that are subject to recurring floods. Flooding occurs when the peak discharge, or rate of flow in cubic feet per second, is larger than the channel of the river or the storm sewer capacity in a city. The peak discharge for a stream is associated with a probability of occurrence. The probability of occurrence can be stated in terms of recurrence intervals or return periods. For example, a probability of occurrence of 10 percent would be a flood expected to occur once in 10 years or 10 times in a 100 years. Flooding damage includes saturation of land and property, erosion from water, deposition of mud and debris, and the fast flowing waters from the flood itself. Most injuries and deaths occur from the fast moving floodwaters and most of the property damage results from the inundation by sediment-filled water. Flash flood conditions result from intense rainfall over a short period of time (Utah Natural Hazards Handbook 42-45).

Snowmelt floods occur from the rapid snowmelt in the mountains. These floods generally happen in April, May and June. Warm air masses with mostly sunny skies melt the mountain watershed snowpack. The large accumulations of water generally last several days and the magnitude depends on the amount of snowpack and the warm weather. Snowmelt flood risk is reduced when the snowpack is below normal and/or the weather changes from winter to spring and summer gradually without an abrupt warming trend (43).

Rainfall floods result from large amounts of precipitation. Short duration local storms such as cloudburst or thunderstorms with a high intensity rainfall as well as the general storm that last several days with a less intense rainfall can produce a flooding event (43).

Areas prone to flooding, according to the Utah Natural Hazards Handbook, include lake and reservoir shorelines, which may flood when the flow of water into the lakes or reservoirs is greater than the outflow capacity. The Great Salt Lake and Sevier Lake are known as terminal lakes, which mean they do not have an outlet. These types of lakes are subject to considerable variations in water levels because the only outflow is by evaporation. Successive wet or dry periods that last several years result in a large change in size in terminal lakes. Development near this type of lake during a dry period is risky and certain to get flooded during wet periods (44).

River and creek floodplain areas range from narrow zones to extensive lowlands extending great distances from a natural drainage area. Construction in floodplains is also dangerous because of the high flood risk.

Urban areas are also prone to flooding because of the decrease in vegetation of the natural watershed. Houses, driveways, parking lots, buildings, and streets are all replacing the vegetative cover that is so important in lessening the potential for flood. This type of development prevents water infiltration into the soil and greatly increases the runoff. In some areas undersized piping and channels are used which may cause flooding. Manmade drainage ways can also play a role in flooding, trash and debris can obstruct passageways (44).

3. Landslide

Utah ranked third in the nation in terms of largest total landslide damage cost and cost per person between 1973 and 1983. Utah's landslide hazard rating is "severe" which is the highest level of five hazard classes given by the Geological Survey. The three main contributing factors to slope failure include areas with moderate to steep slopes, conducive geology, and high precipitation. The main elements that cause slope failure include precipitation events, topography and vegetation (Utah Natural Hazards Handbook 16-22).

Landslide distribution in Utah is associated with topography and physiographic provinces. The two physiographic regions that are conducive to landslides in Utah are the Middle Rocky Mountains province and the High Plateaus subdivision of the Colorado Plateau physiographic province.

Landslides are also known as slope failure and are classified according to the type of movement and the material involved. The five types of movement include falls, topples, slides, lateral spreads, and flows. The types of materials include rocks, debris (course-grained soil), and earth (fine-grained soil). Slope failure types are identified as rock falls, rock topples, rock slides, debris flows, debris topples, debris slides, slumps, and earth flows (17-18).

Rock Falls and Rock Topples occur when loosened blocks or boulders from an area of bedrock move down slope. Rock falls and topples generally occur along steep canyons, cliffs, and steep road cuts. Rock fall damage usually affects roads, railroad tracks, and utilities.

Debris Slides and Debris Flows generally occur in mountainous areas and involve the relatively rapid, viscous flow of course-grained soil, rock, and other surficial materials. Debris flows generally occur in mountainous areas and are considered a flow rather than a slide because of the high water content coupled with the debris. Debris flows are typically more dangerous because of the high speeds under which they form and travel. Debris flows generally remain in stream channels but can flow out from canyon mouths for a considerable distance. Debris flows and slides can damage anything in their path including buildings, roads, railroad tracks, life lines/utilities, and reservoirs.

Slumps are common along road embankments and river terraces. They slip or slide along a curved failure plane away from the upper part of a slope leaving a scarp (a relatively steeper slope separating two more gentle slopes). Slumps generally do not move very far from the source area.

Earth Flows are slumps with the addition of water that slump away from the top or upper part of a slope, leaving a scarp. These can range in size from very small to flows involving hundreds of tons of material and result in a bulging toe that can block streams and cause flooding, and damage buildings or other structures.

Causes of landslides are the result of hillside instability. Slope makeup, slope gradient, and slope weight all play a role. Other important factors of slope instability include rock type and structure, topography, water content, vegetative cover, and slope aspect. Debris flows, for example, occur when these elements are modified by natural processes or by human created processes.

Natural processes that can induce slope failure include ground shaking, wind and water weathering and erosion.

Human created processes involve lawn watering and irrigation. Excess water is the leading cause of landslides because water adds weight to the strength of the material and raises the pore pressure leading to a loss of shear strength. Water can also change the consistency of the slope material reducing cohesion leading to an unstable mixture. Rock types containing clay, mudstone, shale, or weakly cemented units, which, are strongly affected by weathering and erosion are particularly prone to landsliding because of the expansive and lubricating properties. Other processes include the removal or addition of slope materials during construction. Vegetation is very important in the stabilization of slopes because it prevents rainfall from impacting the soil directly and helps protect from erosion by retaining water and decreasing surface

runoff. The roots systems serve as slope-stabilizing elements by binding the soil together or binding the soil to the bedrock. Increase in slope gradient such as placing heavy loads at the top of a slope and /or the removal of material at the toe of a slope all affect the equilibrium and result in slope failure because of slope instability.

4. Wildfire

The Urban Rural Wildland Interface (URWIN) area, or I-Zone, is where residential areas meet wildland areas. It is known as the interface zone and presents a serious fire threat to people and property. The urban aspect includes homes, schools, storage areas, recreational facilities, transmission lines, and commercial buildings. Wildland refers to unincorporated areas including hills, benches, plateaus, and forests. Homes are built on the benches adjacent to wildland areas. Wildfires remove vegetation, which results in slope failure, erosion, water runoff and depletion of wildlife resources. The three conditions that affect fire behavior are topography, vegetation and weather (Utah Natural Hazards Handbook 23-28).

Topography includes such factors as slope, aspect, and elevation. Fires spread faster upslope because the fuels are closer to the flames on the upslope. The heat from a fire moves uphill and dries fuels in front of the fire allowing for easier ignition. The aspect of slope dictates moisture content. In other words, the sun dries out fuels on south and west facing slopes more than on north and east facing slopes. Elevation and weather are interrelated because, generally, higher elevations result in cooler temperatures and a higher relative humidity. Elevation also determines the types of vegetation present (24).

Vegetation plays a major role in the speed of a fire. Light grasses burn rapidly and heavy dense fuels burn slowly but with a greater intensity. The five major fuel types in Utah's vegetation include grass/sagebrush, pinion-juniper, mountain bush, hardwoods, and softwoods. The grass/sagebrush area poses a serious threat because people under-estimate the danger of wildfires in this area. These fires burn across thousands of acres rapidly and pose a serious threat to not only property but also life. Pinion-juniper fuel does not normally burn much, except when conditions are hot, dry, and windy. When a fire does happen here it will burn intensely and spread rapidly. Mountain brush is commonly found in Utah's foothills and if moderate to extreme fire conditions are present this type of fuel will burn hot and fast. Hardwood-forest and softwood (deciduous) fuel types are generally less risky (24).

Size, continuity and compactness all affect the fuel's rate of spread. Large fuels do not burn as readily as smaller fuels and need more heat to ignite. Small fuels on the other hand ignite easier, and a fire will spread more rapidly through them. Continuity is described by how fuel is arranged horizontally. Fuels that are broken up burn unevenly and usually slower than uniform fuels. Compactness is how fuel is arranged vertically. Tall, deep fuels have more oxygen available so they burn more rapidly. Less oxygen is available to compact fuels such as leaf litter and stacked logs therefore they burn slower (24).

Weather, is made up of a few different factors namely temperature, humidity, precipitation, and wind. Weather affects the ease with which a fuel ignites, the intensity at which it burns, and how easy the control may be. High temperatures increase fire danger because they heat fuels and reduce water content, which increases flammability. Humidity influences fuel ignition and how intensely fuel burns. A decrease in relative humidity causes the fuel to become drier and will ignite easier and burn more intensely. Wind can increase burning in the direction that it is moving. Wind carries heat from a fire into unburned fuels drying them out and causing them to ignite easier. The wind may also blow burning embers into unburned areas ahead of the main fires starting spot fires (25).

Fire protection in these areas is difficult because the tactics used for wildland-fire suppression cannot be used for structure protection and suppression. The energy that is emitted from a wildland-fire is very dangerous to firefighters and homeowners and makes protection of homes almost impossible. One third of all firefighter deaths occur fighting wildfires. Many believe that URWIN areas increase the risks to firefighters significantly. Legally federal wildland protection agencies seldom have the responsibility to protect structures, and the legal responsibility for protecting structures on non-federal wildlands varies widely among state forestry agencies (26).

5. Dam Failure

Dams serve various functions and are built by different agencies and entities. Such agencies and entities include The Bureau of Reclamation, Army Corps of Engineers, Soil Conservation Service, cities, counties, and even the private sector. Dams are built for uses such as hydroelectric power generation, flood control, recreation, water storage for irrigation, as well as municipal and industrial uses. Because of Utah's dry summers, it is critical that the winter snowfall is stored for uses all year round. 84% of Utah's stored water is behind federal dams, 650 non-federal dams hold more than 1.2 million acre-feet of water. Dam placement is important and needs to be in an area where they can collect and distribute the greatest amount of water. Dam sites with strong impermeable bedrock are the best in terms of strength. Other materials can be used to construct a dam such as earthen fill, concrete, roller compacted concrete, and rocks and mine tailings. Other dams are created by the enlargement or addition of existing lakes (Utah Natural Hazards Handbook 47-48).

"Rainy Day failures occur when floodwaters overstress the dam, spillway, and outlet capacities. The floodwater flows over the top of the dam and eventually erodes the structure from the top down. At this point the floodwater meets with the floodwaters from the rainstorm and a very destructive, powerful flood is created" (47).

Sunny Day failures are the most dangerous because they happen without any warning. Downstream residents or inhabitants have no time to prepare or even evacuate the area; the results are generally very catastrophic. Sunny day failures occur from seepage or erosion inside the dam. This erosion removes fine materials creating a large void that can cause the dam to collapse, or overtop and wash a way. Earthquake ground shaking or liquefaction can also create structure problems. Ground shaking will cause the dam to start piping, slumping, settling, or experience a slope failure similar to a landslide. The dam would than fail internally or overtop and wash away. Other sunny day failures occur when vegetation or rodents get into a dam and leave holes or tunnels that can lead to failure. Not all dam failures are catastrophic; sometimes a dam can fail and be drained and repaired without a damaging flow of floodwaters (47).

"Hazard ratings are determined by downstream uses, size, height, volume and incremental risk/damage assessments. The hazard ratings are: Low- insignificant property loss; Moderate- significant property loss; High- possible loss of life" (48). Over two hundred of Utah dams are rated as high-hazard dams.

6. Drought

According to the Drought Hazard Mitigation Plan, drought originates from a shortage of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. “Drought could be considered relative to some long-term average condition of balance between precipitation and evapo-transpiration in a particular area”. Drought is also related to the timing and effectiveness of the rains. Drought is a normal, recurrent feature of weather and climate but is a particular concern to all affected because of its devastating outcome. It occurs in almost all climatic zones with varying characteristics. “Drought is a temporary aberration and differs from aridity since aridity is restricted to low rainfall regions and is a permanent feature of climate”. Drought is a dry progression through the winter, spring, and summer months that could end in a year or last for many years. The number of dry years correlates with those affected, usually a one to two year drought affects only agriculture, while a three-year drought typically results in impacts on culinary water in the local areas and communities (13-15).

Conceptual definitions of drought help people understand the idea of a drought.

Operational definitions define the process of drought. This is usually done by comparing the current situation to the historical average, often based on a 30-year period of record. It is hard to develop a singular operational definition of drought because of the striking differences throughout the world (Defining Drought).

Meteorological drought is defined by the degree of dryness in comparison to an average amount and the duration of the dry period. Meteorological drought must be considered as region specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region (13-15).

Hydrological drought refers to the precipitation decline in the surface and subsurface water supply. The frequency and severity of hydrological drought is often defined on a watershed or river basin scale (13-15).

Agricultural drought occurs when there is not enough water available for a crop to grow. This drought links various characteristics of meteorological or hydrological drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapo-transpiration, soil water deficits, and reduced ground water or reservoir levels (13-15).

Socioeconomic drought occurs when the physical water shortage begins to affect people (16-20).

When drought begins, the agricultural sector is usually the first to be affected because of its heavy dependence on stored soil water. If precipitation deficiencies continue, then people dependent on other sources of water will begin to feel the effects of the shortage. Those who rely on surface and subsurface water are usually the last to be affected. Ground water users are often the last to be affected by drought during its onset but may be the last to experience a return to normal water levels. The length of the recovery period is a function of the intensity of the drought, its duration, and the quantity of precipitation received as the episode terminates (18-19).

Measuring Drought:

Palmer Drought Severity Index (PDSI): Wayne Palmer developed the PDSI in 1965. The PDSI is a soil moisture algorithm calibrated for relatively homogeneous regions used by government agencies and states to trigger drought relief programs. The PDSI provides a measurement of moisture conditions that were “standardized” so that comparisons using the index could be made between locations and between months. This is the oldest index for measuring drought and is less well suited for mountainous land or areas of frequent climatic extremes and does not include man-made changes. The PDSI is calculated based on precipitation and temperature data as well as local available water content of the soil. This scale is given as

monthly values and is the most effective in determining long-term drought. The index ranges from –4 to 4 with negative values denoting dry spells and positive values indicating wet spells. The values 0 to -.5 equal normal, -0.5 to –1.0 equal incipient drought, -1.0 to –2.0 equal mild drought, -2.0 to –3.0 equal moderate drought, -3.0 to –4.0 equal severe drought, greater than –4.0 equals extreme drought. The wet spells use the same adjectives in the positive values (What is Drought).

Surface Water Supply Index (SWSI): Shafer and Defman developed the SWSI in 1982. This index uses the same basic classifications as the Palmer Drought Index and is designed to complement the Palmer in the western states. The SWSI is more of an indicator of surface water conditions and described as "mountain water dependent", in which mountain snowpack is a major component; calculated by river basin, based on snowpack, stream flow, precipitation, and reservoir storage. The objective of the SWSI was to incorporate both hydrological and climatological features into a single standardized index value. The pros and cons of the SWSI is that the index is unique to each basin. The SWSI is centered on 0 and has a range between –4.2 (extremely dry) and 4.2 (abundant supply). The index is calculated by combining pre-runoff reservoir storage with forecasts of spring and summer stream flow that is based on hydrologic variables (What is Drought).

Standardized Precipitation Index (SPI): T.B. McKee, N.J. Doesken, and J. Kleist of the Colorado State University, Colorado Climate Center formulated the SPI in 1993. The Standardized Precipitation Index was designed to quantify the precipitation deficit for multiple time scales; basically, the SPI is an index based on the probability of precipitation for any time scale. It assigns a single numeric value to the precipitation that can be compared across regions with different climates. The SPI is calculated by taking the difference of the precipitation from the mean for a particular time scale and dividing by the standard deviation. The SPI is normalized and so the wetter and drier climates can be represented in the same way. The SPI can provide early warning of drought and help assess drought severity yet the values based on preliminary data may change. The SPI values indicate an extremely wet period value at 2.0+, very wet equals 1.5 to 1.99, moderately wet is 1.0 to 1.49, -.99 to .99 is near normal, -1.0 to –1.49 moderately dry, -1.5 to –1.99 is severely dry, -2 and less is extremely dry. The time scales were originally calculated for 3-, 6-, 12-, 24-, and 48- months (What is Drought).

After review of 33 gaging stations, the drought analysis in Utah indicated that a localized drought has occurred on at least one stream every year since 1924. The duration of drought lasts longer in basins where runoff is mainly from snowmelt. The frequency of occurrence is greater for areas in the Wasatch Range than in the Wasatch Plateau, the mountain of southwestern Utah, or the Uintah Mountain range. Because Utah relies on surface water supplies, about 81% of the population relies on off stream water use and 35% of the population relies on surface water supplies, drought severely affects the people and industry of the whole state.

7. Infestation

Infestation has plagued this region since the early 1800's and continues to be a problem. Infestation is known as a parasite that over-populates in numbers or quantities large enough to be destructive, threatening, or obnoxious. Past infestation events have been devastating enough for presidential disaster declarations because of the destruction to food supplies that affect wildlife, livestock, and agricultural lands including alfalfa, wheat, and barley. Crickets, katydids, grasshoppers, and worms tend to be the most damaging and affect the rural areas the most. With the recent drought in the area the predators decrease. The drought also affects the food supplies and so the insects begin to search over a wider area when in search of food.

8. Severe Weather

Avalanche: According to Sandra Eldredge, Utah Geological Survey "a snow avalanche is the rapid down-slope movement of snow, ice, and debris. Snow avalanches occur in the mountains of Utah as the result of snow accumulation and unstable snowpack conditions." Ground shaking, sound, or a person treading in an avalanche area can trigger a slide that can cover a wide area or can be concentrated to a smaller more or narrow path. An avalanche consists of a starting zone, a track, and a runout zone. The starting zone is where the ice or snow breaks loose and starts to slide; this zone can be triggered by human and/ or natural activities. Human induced avalanches can result from snowmobilers, backcountry skiers, or other outdoor recreationalists triggering the avalanche because of ground shaking. The two main natural factors that affect avalanche activity include weather and terrain, large frequent storms combined with steep slopes result in avalanche danger. Other factors that contribute to the stability of the snowpack include the amount of snow, rate of accumulation, moisture content, snow crystal types and the wind speed and direction. The Track is the grade or channel down which an avalanche travels. The runout zone is where an avalanche stops and deposits the snow. For large avalanches, the runout zone can include a powder-or windblast zone that extends far beyond the area of snow deposition. In Utah, avalanches are the number one natural hazards that kill more people and ironically are triggered by the victim. Each winter an average of four people die in Utah due to avalanche activity (Utah Natural Hazards Handbook 50-53).

Weather and terrain conditions affect avalanche conditions. The weather controls the durations and the extent of an avalanche while terrain is the element that determines where, why, and how an avalanche occurred. In Utah, the months of January through April pose the greatest avalanche potential. Weather related aspects that affect the snowpack stability include rate of accumulation, amount of snowfall, moisture content, wind speed and direction, and snow crystal type. Wind can deposit snow 10 times faster than snow falling from a storm without accompanying wind. This affects avalanche potential because the underlying weak layer of snow cannot adjust to the new load. Rain and the melting of snow can almost instantly cause an avalanche because of the added weight 50-51).

Terrain includes such variables as slope, aspect, elevation, roughness and angle. The slope is important in understanding where an avalanche will occur. Slopes greater than 45 degrees are too steep because the snow continually sluffs off, however slopes greater than 20 degrees can produce avalanches. Optimum slope degree is between 30 to 45 degrees, which is also the optimum angle for backcountry skiers. This slope angle is where approximately 99.9 percent of avalanches occur. The slope aspect and elevation affect the snow depth, temperature, and moisture characteristics of the snowpack. Slope aspect, such as north facing or shady slopes usually produce more avalanches and more persistent avalanche hazards occur during mid winter months. In the spring, south facing slopes produce more wet avalanches from the strong sun (Utah Avalanche Center).

Slope shape and roughness correlate with snowpack stability. Roughness identifies boulders, shrubs, and trees that can help slow, or reduce avalanche speed and impact. A bowl shaped slope is more prone to an avalanche than a ridge or cliff.

Dry avalanche is when a cohesive slab of snow that fractures as a unit slides on top of weaker snow and breaks apart as it slides. Dry slab avalanches occur usually because too much additional weight has been

added too quickly, which overloads the buried weak layer, even the weight of a person can add a tremendous stress to a buried weak layer. Dry snow avalanches usually travel between 60-80 miles per hour within 5 seconds of the fracture and are the deadliest form of snow avalanche (Utah Avalanche Center).

Wet Snow avalanches occur for the opposite reason of dry avalanches; percolating water dissolves the bonds between the snow grains on the pre-existing snow, which decrease the strength of the buried weak layer. Strong sun or warm temperatures can melt the snow and create wet avalanches. Wet avalanches usually travel about 20 miles per hour (Utah Avalanche Center).

Avalanches can result in loss of life as well as economic losses. What are at risk are some communities, individual structures, roads, ski areas, snowmobilers, backcountry skiers, snowshoers, snowboarders, and climbers. Avalanches can reach speeds up to 200 miles per hour and release enough force to wipe out everything in its path. One of the major consequences of snow avalanches is the burial of structures, roads, vehicles, and people in the runout zone where tens of feet of debris and snow can be deposited (51).

Severe Storm: Winter storms gain their energy from the collisions of two air masses. In North America a winter storm is usually generated when a cold air mass from dry Canadian air moves south and interacts with a northward moving warm moist air mass from the Gulf of Mexico. The position where a warm and a cold air mass meet is called a front. If cold air is advancing and pushing away the warm air the front is known as a cold front. If the warm air is advancing, it rides up over the cold air mass and the front is known as a warm front. A winter storm will typically begin under what is known as a stationary front. A stationary front is when neither air mass is advancing. The atmosphere will try to even out the pressure difference by generating an area of lower pressure; this creates wind that blows from high pressure towards a low-pressure area. As the air travels toward the center of the low-pressure area it is pushed up into the colder regions of the upper atmosphere because it has nowhere else to go. This causes the water vapor to condense as snow in the northern areas because of the colder temperatures. In the south, if the temperatures are warm enough the water vapor will fall as heavy rain in thunderstorms. Because of the easterlies in Northern America the winter storm moves quickly over the area and generally does not last longer than a day in one area. However, in Utah because of the Great Salt Lake “lake-effect” snowstorms can last for many days. This is because of the amount of moisture from an unfrozen body of water. When a strong cold wind blows over a larger area of water, the air can attain a substantial amount of moisture; this moisture turns into heavy snow when it reaches land causing a lake effect snowstorm (All About Winter Storms).

Strong winds often accompany a winter storm creating blizzard conditions; dangerous wind chill, severe drifting and can knock down trees, power lines, and utility poles (Severe Weather Safety).

Extreme Cold: Prolonged exposure to the cold can cause frostbite or hypothermia and can become life threatening (Severe Weather Safety).

Ice Accumulations can bring down electrical wires, telephone poles and lines, trees, and communication towers. Ice can also cause extreme hazards to motorists and pedestrians (Severe Weather Safety).

Heavy Snow can stop a region by stranding commuters, stopping the flow of supplies, disrupting emergency and medical services, close infrastructure and services (Severe Weather Safety).

Severe Thunderstorm usually last around 30 minutes and are typically only 15 miles in diameter. But they all produce lightning. They can also lead to flash flooding from heavy rainfall, strong winds, hail and tornadoes may also accompany a thunderstorm (Severe Weather Safety).

Extreme Heat: Heat-related illnesses affect people, this happens when their bodies are unable to compensate and properly cool themselves. Usually a body will sweat to cool itself, however under some conditions, sweating isn’t enough and a person’s body temperature will rise that can cause damage to the brain or other vital organs. This can happen when the humidity is high, sweat will not evaporate as quickly, preventing the body from releasing heat quickly; other conditions include age generally the elderly and young, obesity, fever, dehydration, heart disease, mental illness, poor circulation, sunburn, and prescription

drug use and alcohol use (Extreme Heat). Extreme heat can manifest in several ways including sunburn, heat exhaustion, heat stroke, and heat cramps (Severe Weather Safety).

Waterspouts are weak tornadoes that form over warm water and in Utah they can occur with cold late fall or with late winter storms (Tornadoes).

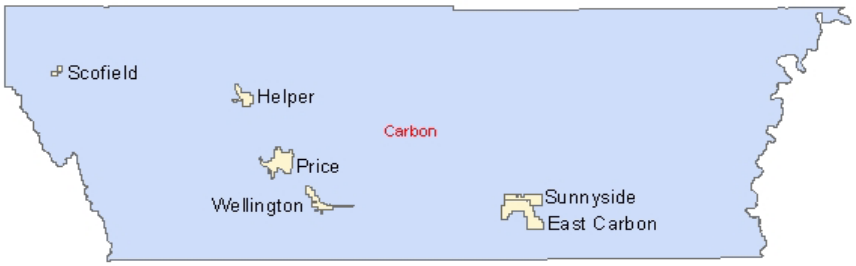
Tornado: Expressed as a violently rotating column of air extending from a thunderstorm to the ground. A tornado is often on the edge of the updraft or next to the air that's coming down from the thunderstorm. The tornado's vortex is a low-pressure area and as air rushes into the vortex, its pressure lowers and cools the air. This cooler air condenses into water vapor in the funnel cloud, known as the vortex, and doesn't touch the ground. The swirling winds of the tornado pick up dust, dirt, and debris from the ground, which turns the funnel cloud darker. Some tornadoes can have wind speeds up to 250 miles per hour or more with a damage zone of 50 miles long and 1 mile wide. But most tornados have winds less than 112 miles per hour, are less than 100 feet wide, and generally do not last longer than 10 minutes. They generally move along the ground 20-50 miles per hour. While a tornado can happen anytime, for the northern parts of the state tornadoes happen more frequently during the summer (Tornadoes). A change in wind direction and an increase in wind speed along with increasing height create an invisible, horizontal spinning effect in the lower atmosphere form a tornado while the rising air within the thunderstorm updraft tilts the rotating air vertically resulting in what we call a tornado. The area of rotation is generally 2-6 miles wide and extends through much of the storm (Tornadoes).

Scale: Tornadoes are classified by wind damage using the Fujita Scale that was accepted for use by the National Weather Service in 1973. The scale uses numbers from 0 through 5 with the ratings based on the amount and type of wind damage (Tornado Safety).

Fujita Scale
F-0: Winds up to 72 mph, Light damage, down tree branches, chimney damage
F-1: Winds 73-112 mph, Moderate damage, mobile home damage
F-2: Winds 113-157 mph, Considerable damage, mobile home demolished, trees uprooted
F-3: Winds 158-206 mph, severe damage, roofs and walls torn down, trains overturned, cars thrown
F-4: Winds 207-260 mph, Devastating damage, well-constructed walls leveled
F-5: Winds over 261 mph, incredible damage, homes lifted off foundation and carried, autos thrown as far as 100.

Part 7. Carbon County

Carbon County is a large county in terms of land area and is made up of six municipalities: East Carbon City, City of Helper, Price City, Scofield Town, Sunnyside City, and Wellington City. Carbon is located in the mid-eastern portion of the State.



A. Demographics and Population Growth

The following information involving Population Estimates, Average Annual Rate of Change, and Population and Development Trends is important in understanding the impacts that a natural hazard would have on a local community. Population numbers also identify the constancy of a community by determining the degree of change a community (Table 7-1).

Table 7-1 Carbon County Population

	Carbon County	East Carbon	Helper	Price	Scofield	Sunnyside	Wellington	Balance of Carbon	Southeast
1980 Census Population	22,179								54,124
1990 Census Population	20,228	1,270	2,148	8,712	43	339	1,632	6,084	49,801
2000 Census Population	20,422	1,393	2,025	8,402	28	404	1,666	6,504	54,180
2005 Population Projections	20,562								54,559
2010 Population Projections	21,801								57,699
2015 Population Projections	23,769								62,754
2020 Population Projections	25,236								66,489
2030 Population Projections	25,848								67,867
1990-2000 AARC	.01%	0.9%	-0.6%	-0.4%	-4.2%	1.8%	0.2%	0.7%	
2000-2030 AARC	0.79%								0.75%

1990-2000 Percent Change	1.0%								
Rank by 2000 Population	13								
Rank by Percent Change	29								
Rank by AARC	29								
Source: Bureau of the Census, 2002 Baseline Projections, and Utah Population Estimates Committee. Governor's Office of Planning and Budget. 1980 and 1990 populations are April 1 U.S. Census modified age, race and sex (MARS) populations; 2000 populations, household sizes and households are April 1 U.S. Census summary file 1 (SF1) populations; all others are July 1 populations. Note AARC is average annual rate of change.									

B. Economy

The principle towns in Carbon County include Price, Helper, Wellington, East Carbon and Sunnyside. The County's economy relies on coal mining, transportation/railroad, energy, government, services, trade, and tourism. Coal mining has long played vital role in the county's economic and social development. Utah Power and Light built a large electric generating plant in the county. Ninety-eight percent of the power for the company comes from coal-burning thermal plants (Carbon County). The College of Eastern Utah located in Price also plays a significant role in the County's cultural diversity and economic development.

In 2002, the Carbon County unemployment rate was 5.6 (just above the state's 5.1 percent average), non-farm jobs rose 3.4 percent in the first quarter and 6.5 percent in the second quarter, and the mining industry rebounded with around 180 jobs. The service sector (trade, transportation, information, recreation, lodging, and food services) expanded during the first two quarters of 2002 along with fabricated metal manufacturing, construction jobs, health care and social assistance, and goods-production employment. On the downside was the trucking and rail transportation businesses and local government jobs, namely education. The 2002 outlook continues to see an upward trend, but relies heavily on the sustainability of mining jobs (Carbon County Trends). The 2000 estimated average house value is $78,637 (Annual Statistical).

C. Transportation and Commuting Patterns

The major transportation routes within Carbon County are Highways 6, 10, 123, and 191. The principle north-south corridors through the county are Highways 6 and 191. State Highway 10, between Price and Emery, is the major highway for the populated section of the county, connecting Price to I-70 to the south. Highway 123 runs from highway 6 east through the towns of East Carbon City and Sunnyside (Traffic Volume Map).

D. Land Use and Development Trends

Seventy-six percent of the property in Carbon County is owned and managed by the federal government, 8.7% is owned by the State, and 13.7% is privately owned (Consolidated Plan). These land ownership patterns are similar to many of Utah's rural counties. Because the Federal government administers the majority of the land within Carbon County they play a large part in mitigation efforts identified in subsequent sections of this plan. In many cases city development is surrounded by federal land boundaries.

Land development trends for the last 100 years have been principally influenced by the volatile mining industry. Over the last twenty-five years the county has experienced slow and steady development growth mainly in Price, Helper, Wellington, and East Carbon. As available lots were developed within municipalities, growth spread to small and medium sized lots along county roads and/or unincorporated portions of the county. Agricultural growth has also increased with the purchase of "mini-farms" from one-

half to twenty-acres. Suburban development in the larger communities has increased the demand for more community services and infrastructure.

Price City, considered a regional hub city, hosts the county seat and retains the majority of the region's businesses as well as a junior college. Price City is considering annexing surrounding residential and commercial developments.

Carbon County's second largest city, Helper City, is experiencing a financial depression due to closures of the bigger mines (Castle Gate and Willow Creek), and a consolidation of the railroad. The city is currently struggling to restore its historic downtown district and to rejuvenate its infrastructure.

Wellington is the third largest city within Carbon County. Wellington's economy is based on agriculture and a few small businesses and has always struggled with growth. Wellington functions as a bedroom community of Price City and the surrounding areas.

In 1981 the county adopted development codes and building ordinances. In March 2003 these codes and ordinances were revised.

Over the last ten years Carbon County's population growth has been below 1% overall. This trend includes seasons of both local and countywide negative growth. As a result, overall development has been minimal. Building Permits issued from 1998-2002 are as follows.

- Residential permits consist of a large variety of construction activity on residential premises including (but not limited to) remodels, additions, gas meter, electrical upgrade, re-roof, garage, single-family dwellings, manufactured homes, and mobile homes in parks.
- Dwelling permits include single-family dwellings, manufactured homes (new and used), and mobile homes in parks.
- Commercial permits include all construction activity on commercial property.
- Industrial permits include mining, gas wells, etc.

GORDON CREEK & CARBONVILLE & WESTWOOD

310	Residential
139	Dwelling
15	Commercial
10	Industrial

SPRING GLEN & KENILWORTH

164	Residential
24	Dwelling
3	Commercial
4	Industrial

SOUTH PRICE & MILLER CREEK & DRUNKARDS WASH & HIAWATHA & RIDGE RD

314	Residential
124	Dwelling
33	Commercial
25	Industrial

COAL CREEK & CLARKS VALLEY & NINE MILE

22	Residential
12	Dwelling
1	Commercial
11	Industrial

SCOFIELD MOUNTAIN AREA & CLEAR CREEK & BEAVER CREEK

146 Residential
54 Dwelling
2 Commercial
0 Industrial

SCOFIELD TOWN

46 Residential
3 Dwelling
1 Commercial
0 Industrial

HELPER & SPRING CANYON

197 Residential
9 Dwelling
9 Commercial
0 Industrial

EAST PRICE

4 Residential
5 Dwelling
9 Commercial
4 Industrial

WELLINGTON

193 Residential
66 Dwelling
5 Commercial
1 Industrial

SUNNYSIDE & WHITEMORE CANYON & BRUIN

42 Residential
6 Dwelling
1 Commercial
1 Industrial

Employment

Five hundred and seven people entered the Carbon county workforce last year. This is an increase of 5.3% over the previous year. However, the overall unemployment rate increased from 6.96% to 8.34%, or a 1.37% total rate increase. This means that only 66% of the new entries found gainful employment, assuming that last year's workforce retained their employment status.

Residential

Most residential growth in Carbon County occurs in the Circle K and Westwood areas just west and outside of Price City boundaries. The largest growth in the county occurs in summer homes in and around Scofield Town. Real estate sales are higher this year than last by 281.4%, but most sales are of existing stock rather than new construction.

Commercial

Most commercial development occurs in and around Price city.

Industrial

Most heavy industrial development has occurred south of Price along Highway 10 and on Ridge road.

Natural Resource Production
Carbon County mining revenues are down 24.0% from last year -- from $11.6 million to $8.8 million. Development of gas wells and high-pressure gas lines in and around the Drunkards Wash area has slowed down recently. Wholesale gas sales are down by 12.6% from last year. Bill Barrett Corp. is contemplating a major development in the Northeastern part of the county around Nine-Mile canyon that may be three times larger in volume than previous county fields.

Roads and Infrastructure
UDOT is currently in the process of widening U.S. 6 from Price to Wellington from two lanes to four. Crews are currently relocating utility lines, which should be completed in November 2004. UDOT is also doing a rotomill, overlay and chip seal project on U.S. 6 from Price Canyon Mile Post 202 to 238; this project was expected to be complete by September of 2003.

Water
Price city and Helper have their own water treatment and distribution but PRIWD handles wastewater. Sunnyside and East Carbon cities jointly own water service through Grassy Trail.

Power
Utah Power supplies electrical power to all of Carbon County.

Carbon County's Future:
Carbon County has specified in the community plan that they will not spot zone, and will avoid practices not consistent with the community plan. Industrial development will be compatible with the limited water supply. Carbon County is also looking at rezoning the areas that are not appropriately zoned to ensure that industry types will remain consistent with their locations. Carbon County will continue to allow for various types of residential development and will keep these areas away from industrial zones and high-volume traffic corridors.

Carbon County will preserve open lands and assist farmers to keep these lands in agricultural production. Preservation can take place through the formation of Agriculture Protection Areas, zoning, and by easing the demand for those lands. The county will also preserve some areas of the mountains and hillsides for no development. Areas that provide critical wildlife winter range and critical watershed will be excluded from development. The county will also preserve the quality of its communities and rural areas, and develop an outdoor advertising sign ordinance.

The county will also protect and enhance those areas that have potential for outdoor activities. The Price River corridor will be developed and enhanced with trails. Preservation of access to the trails systems and planning of residential areas near parks and trails will be encouraged.

As cities and towns have incorporated and grown in the county, incompatible land uses have risen along boundaries. Coordination between municipalities for future development plans will reduce future incompatibility.

E. Risk Assessment

The risk assessment process found Carbon County to be vulnerable to the following hazards: Dam Failure, Flood, Wildland Fire, Landslide, Problem Soil, and Infestation. Carbon County is also vulnerable to drought, severe weather and to a lesser degree - earthquake; these hazards are all covered in a regional annex as Carbon County's condition affects the entire region. Vulnerability maps (found at the end of this section), were compiled for the hazards of dam failure, wildfire, landslide, problem soils, and earthquake. A GIS based risk assessment was completed where appropriate. Refer to Appendix C for a complete list of the critical facilities.

1. Dam Failure

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
		Limited	10-25%
		Critical	25-50%
	X	Catastrophic	More than 50%
Probability		Highly Likely	
		Likely	
	X	Possible	
		Unlikely	
Location	See map in Section H Dam locations are mainly in the southeastern portion of the county.		
Seasonal Pattern or Conditions	Rainy Day Failure happens mainly during heavy precipitation events, can have some warning time. Sunny Day Failure happens with no warning at all can happen at anytime.		
Duration	Hours, Days. Depends on spillway type and area, maximum cfs discharge, overflow or breach type, dam type. Refer to Dam Inventory for more information.		
Analysis Used	Review of BOR inundation maps and plans, FIS, Water Rights.		

Description of Location and Extent

Twenty dams are located in Carbon County, but only one dam is considered a high hazard. A high hazard is defined as a possibility of life being lost due to dam failure. Two dams are listed, as having a moderate hazard rating, meaning there is a significant likelihood of downstream property loss if the dam were to fail. The remaining seventeen dams have a low hazard rating; meaning if they were to fail there would be insignificant property loss (Table 7-4). All dams, regardless of rating should be monitored. It should be noted, dam safety hazard classifications are in the event of dam failure and are based upon the consequences of dam failure. Therefore, the classification of a high hazard dam does not mean that the dam has a high probability of failure.

Table 7-4 Dam Hazard Rating

Dam Name	Hazard Rating
1) Scofield Reservoir	High
2) Grassy Trail Reservoir	High
3) Sunnyside Co-Generation Reservoir	Moderate
4) Price Storm Water DB	Moderate
5) Anderson East	Low
6) South	Low
7) US Steel Corp Tailing Up	Low
8) Sunnyside Cogeneration Dragert	Low
9) US Steel Corp Storage	Low
10) US Steel Corp Tailings	Low
11) Mud Springs Reservoir	Low
12) Olsen	Low
13) Powell	Low
14) Millerton	Low
15) Abbott	Low
16) Castle Valley SP SVC DST- Elmo	Low
17) Desert Lake- Desert Lake Dike	Low
18) Rowley Brothers	Low
19) Desert Lake –Wash Lake	Low
20) Desert Lake –Old Desert Lake	Low
21) Desert Lake –Fawn Lake	Low

In the following narrative, downstream towns have been identified that could be potentially affected if any of the identified reservoirs were to breach. However, potential dollar losses were unable to be evaluated for dam failure due to the lack of dam inundation maps that would be needed to conduct such a study.

East Carbon and Sunnyside Cities

The Grassy Trails Reservoir was built in 1952 and is jointly owned by East Carbon and Sunnyside Cities. A possible dam breach would affect both East Carbon and Sunnyside, which are 7 miles from the reservoir. This reservoir is considered to have a high hazard threat and the need for mitigation is imminent. The reservoir storage at the spillway crest is 916 acre-feet and the storage at the dam crest is 1,156 acre-feet. Maximum dam breach flow would be 16,000 cubic feet per second.

The Sunnyside Dam has a moderate hazard rating. It was built in 1992 and is owned by Sunnyside Cogeneration Associates. The reservoir storage at the open channel spillway is 123 acre-feet. The first downstream town is East Carbon City, which is only 0.5 miles away.

Helper City, Spring Glen, Carbonville, Price City, and Wellington City

The Scofield Dam is 10 miles northeast of the town of Scofield. It was constructed in 1943-1946 and has a 73,600 acre-feet capacity. If it were to fail, it would exhibit a natural breech failure. The drainage area is 161 square miles, the storm duration could last 80 hours, and the peak inflow is 41,000 cubic feet per second. This dam does not have a hazard rating at this time but if it were to breach many areas near the Price River would suffer severe damage from the water and from the lack of the water, including parts of Helper, Spring Glen, Carbonville, Price, and Wellington. Most of the populated areas of the entire county depend heavily on this large water supply.

Price City

The Price Stormwater Dam, owned by Price Municipal Corporation, is planned and/or under construction at the time of the writing of this plan. The reservoir storage at spillway crest will be 900 acre-feet. The first downstream town is Price located just 0.1 miles away. At this time the dam has not been rated.

Vulnerability Assessment

The risk assessment values for dam failure were difficult to analyze due to the quality and age of the dam inundation maps from the Dam Safety Section of Utah Water Rights. The municipalities, roads, critical facilities, and GIS layers were superimposed over the dam identification layers. This analysis reveals the geographic extent of the dams and the critical facilities within the hazard areas. This analysis could not identify potential dollar loss estimates using the available data.

The Carbon County GIS Department overlaid county assessor data, and parcel data from Census 2000 and 2001 with county dam inundation maps.

Figure 7-1, the process used to figure the statistics shown was by selecting the parcels that intersect with the inundation zone. Out of 1498 records 177 of these have either 0 or null value. There are approximately 100 parcels in Helper City that are missing (Figure 7-1).

Figure 7-2, the process used to figure the statistics shown was by selecting the parcels that intersect with the inundation zone. Out of 172 records 50 of these have either 0 or null value. Some parcel information was not available (Figure 7-2).

Figure 7-1

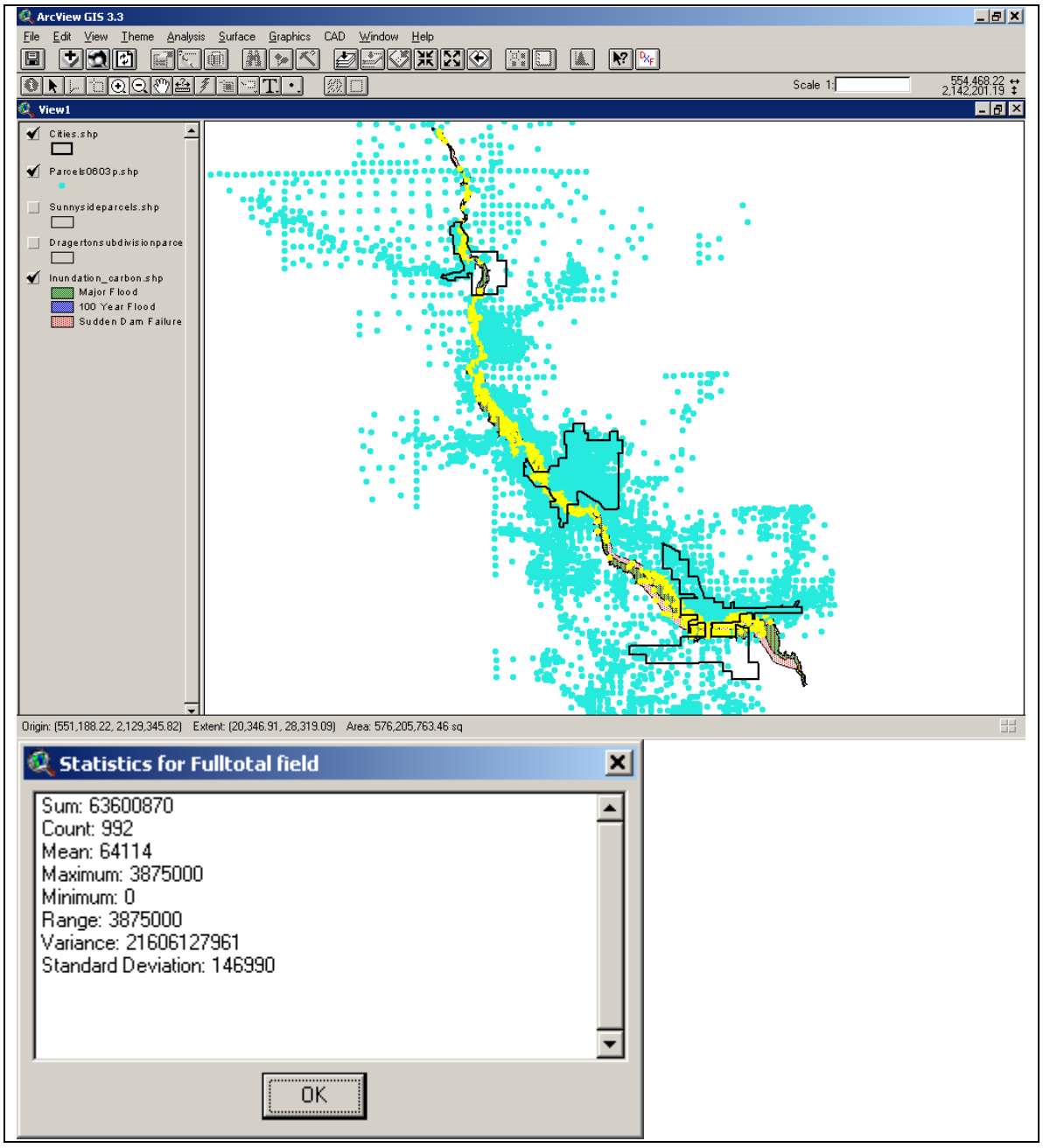
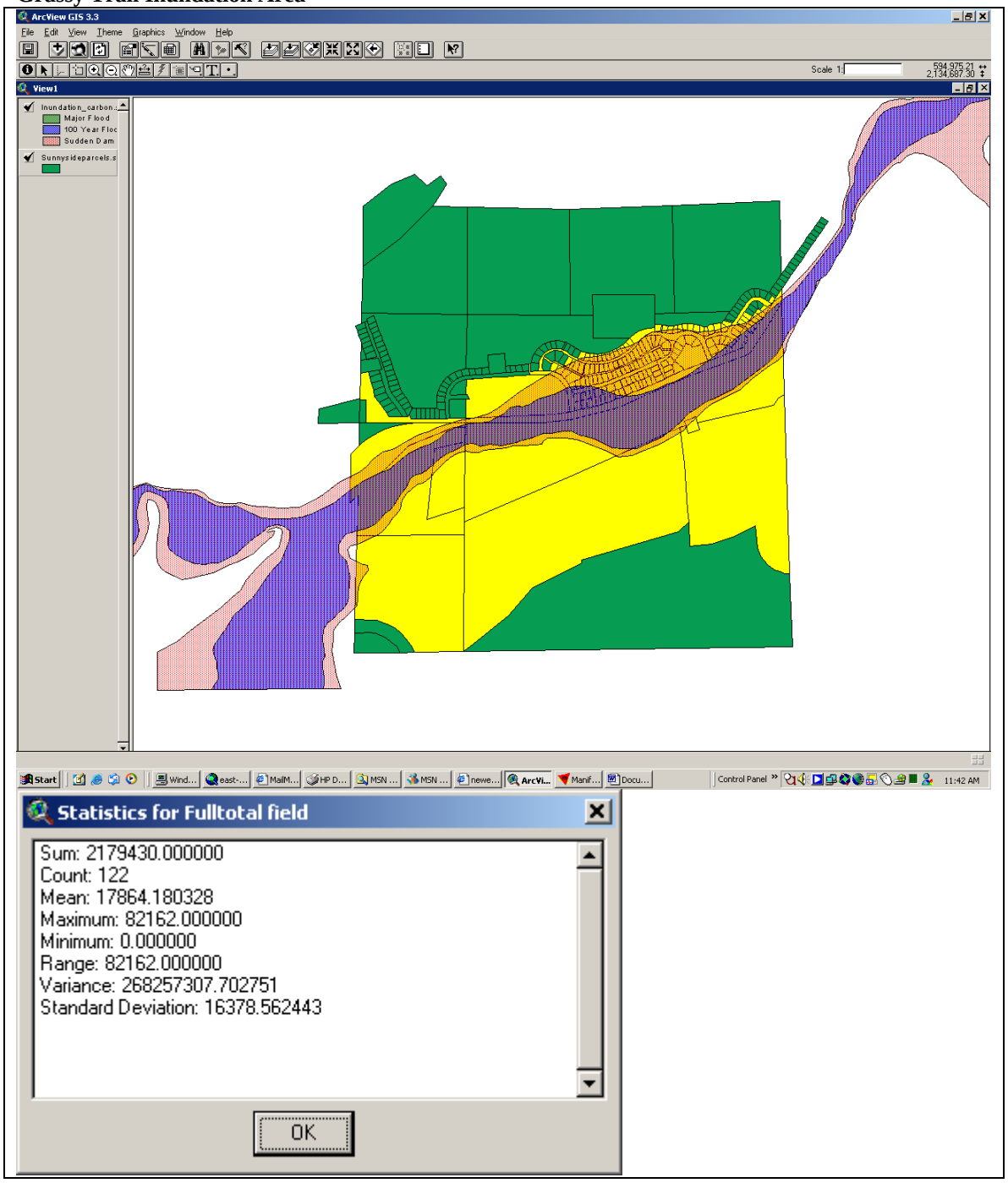

ArcView GIS 3.3
File Edit View Theme Analysis Surface Graphics CAD Window Help
Scale 1:
554,468.22
2,142,201.19
View1
Cities.shp
Parcels0603p.shp
Sunnysideparcels.shp
Dragertonsubdivisionparce
Inundation_carbon.shp
Major Flood
100 Year Flood
Sudden Dam Failure
Origin: (551,188.22, 2,129,345.82) Extent: (20,346.91, 28,319.09) Area: 576,205,763.46 sq
Statistics for Fulltotal field
Sum: 63600870
Count: 992
Mean: 64114
Maximum: 3875000
Minimum: 0
Range: 3875000
Variance: 21606127961
Standard Deviation: 146990
OK

Figure 7-2

Grassy Trail Inundation Area



2. Flood

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
	X	Limited	10-25%
		Critical	25-50%
		Catastrophic	More than 50%
Probability	X	Highly Likely	
		Likely	
		Possible	
		Unlikely	
Location	See map in Section H		
Seasonal Pattern or Conditions	Spring, cloudburst storms and heavy snowfall runoff.		
Duration	Flooding can last anywhere from hours to days and even months.		
Analysis Used	Review of FIS, FIRM, Army Corp of Engineers Flood Study, Hazard Analysis Plans, GIS data		

Description of Location and Extent

The local planning team members, including the County GIS department, were able to identify and map flood prone areas within the county. The core planning team utilized this research to conduct the risk assessments. The Army Corps of Engineers compiled a Flood Hazard Identification Study in 2003 that addressed unmapped communities within Southeastern Utah (Appendix E).

The entire county can experience flooding near the low-lying areas. The Price River and its tributaries, Cardinal Wash, Meads Wash, Spring Glen Wash, Spring Canyon Wash, Soldier Creek, Coal Creek, Hayes Wash, Deadman Creek, Drunkard Wash, Pinnacle Canyon Wash, Gordon Creek, Garley Canyon Wash, Consumers Wash, and Willow Creek all have the possibility to overflow. The Price River above the confluences of the Cardinal, Meads, Spring Glen, and Spring Canyon Washes, as well as Gordon Creek all tend to flood. The Price River is the main drainage system that flows southwest through Carbon. Overflow generally occurs during summer and fall cloudburst storms.

The following canals also pose a threat to Carbon County: Carbon, Price-Wellington, and Spring Glen. The Carbon Canal is an earthen canal that could potentially affect the west side of Price, Westwood, and Robertson subdivisions. The Price-Wellington earthen canal could threaten the north half of Price and Wellington. The earthen Spring Glen Canal could pose a threat to Spring Glen. The Price River floodplain between Price City and Helper City has the highest degree of development. The recurrence interval is a long-term average period between floods of a specific magnitude. However, rare floods could occur at short interval recurrence periods (review the Hazard History portion at the end of this section to identify past occurrences).

Vulnerability Analysis

Due to the lack of digitized floodplain maps potential dollar loss estimates were unable to be completed during the making of this plan.

3. Wildland Fire

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
		Limited	10-25%
	X	Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
	X	Likely	
		Possible	
		Unlikely	
Location	URWIN zones near the foothills and in forested areas. See map in Section H		
Seasonal Pattern or Conditions	Summer months. Areas affected by drought and/ or heavily overgrown and dry brush and debris. Lightning and human triggers.		
Duration	Wildfires typically last days but can last months, depending on climate and fuel load as well as resources (financial, manpower) to extinguish the fire.		
Analysis Used	Review of plans and data provided by US Forest Service, National Climate Center, FEMA, AGRC, County Hazard Analysis Plans, and DESHS.		

Description of Location and Extent

The Division of Emergency Services and Homeland Security augmented a statewide wildfire database to represent wildfire vulnerability into five categories: Extreme, High, Medium, Low, and Very Low. These ratings cover all of Carbon County and are based on the type and density of vegetation in each area. Additional factors influencing wildland fires such as weather conditions, wind speed and direction are not considered in this risk assessment.

Vulnerability Analysis

Loss estimates were made by identifying the wildland fire areas of extreme, high, and moderate within the county and then overlaying the infrastructure and the housing GIS databases to identify vulnerable areas. The following table includes the population, number of commercial, and number of residential structures inside extreme, high, and moderate wildfire risk areas within the county (Table 7-5).

Table 7-5 Structures and Population in Wildfire Area

Use Type	Extreme Risk	High Risk	Moderate Risk
Commercial Units / Annual Sales	16 / $10.9 Million	77 / $102 Million	60 / $150 Million
Residential Units / *Est. Replacement Cost	638/$50,170,406	954/$75,019,698	592/$46,553,104
Population	1347	2048	1491

*Replacement cost does not include contents, which would increase the values list by approximately 50%.

Wildfire Risk with Municipal Boundaries

Table 7-6 Wildfire Risk Area contains the number of acres in each wildfire risk area within the municipal boundaries of the following cities in Carbon County.

Table 7-6 Wildfire Risk Area

City Name	Acres of Extreme	Acres of High	Acres of Moderate
Helper	305	188	12
Price	56	637	286
East Carbon/Sunnyside	843	2210	1171
Wellington	0	0	0

Table 7.7 Infrastructure affected by Wildfire

Item	Length (Miles)	Replacement Cost
Local Roads	41.57	$83,149,600
State Highways	46.31	$111,760,738
US Highways	8.18	$19,740,499
US Interstates	0.25	$900,000
Power Lines	143.93	$6,948,940
Gas Lines	0.00	$0

Table 7.8 Wildfire Hazard History

Date	Fire Name	Cause	Size
9/11/88	Bear Fire	Lightning	300 - 999 Acres
7/25/96	East Carbon	Lightning	1000 - 4999 Acres

4. Landslide

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
		Limited	10-25%
	X	Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
		Likely	
	X	Possible	
		Unlikely	
Location	See map in Section H. Generally occur in canyon mouths and foothill areas.		
Seasonal Pattern or Conditions	Spring and Summer usually caused by the stress release of over-weighted soils and or loosening of rock and debris.		
Duration	Landslides generally last hours or days, but some can last weeks.		
Analysis Used	Information and maps provided by UGS, DESHS, AGRC.		

Description of Location and Extent

The map "Carbon County Landslide Hazard" shows the locations of potentially active landslides, and identifies historical landslides and their locations. Landslides are generally located in well-defined, localized areas, but when they occur is usually unpredictable. The impact of a landslide can be countywide.

Several areas in the county pose landslide risks. The largest landslide threat in the county is along the Book Cliff Mountain range where landslides have historically taken place. Specific areas include the Cave Hollow subdivision, which has development adjacent to steep slopes, and the areas of 100 East St. from 500 North to 800 North in Price. This area could be affected because the backyards of these homes are along the base of Wood Hill. Price Canyon has the water treatment facility that could be damaged in a landslide or slope failure event. The Wasatch Plateau has also experienced several landslides. A major landslide event took place north and west of the Town of Thistle in Utah County, but its impact severely affected Carbon County's economy. In 1983, the Thistle landslide destroyed the major highway and railroad connecting Price City with the Wasatch Front. Residents were unable to conduct business effectively in and out of Price City and freight costs increased dramatically.

Vulnerability Assessment

Tables 7-9 and 7-10 identify the infrastructure within landslide areas. In order to accurately capture landslide risks in these areas a more detailed assessment using parcel data rather than Census Block data is required.

Table 7-9 Inventory of Properties in Landslide Risk Areas

Use Type	Number	Estimated Value
Commercial Units	0	0
Residential Units	97	$7,627,789
Population	127	N/A
Total Estimated Loss $7,627,789		

Table 7-10 Infrastructure affected by Landslide

Item	Length (Miles)	Replacement Cost
Local Roads	1.01	$2,020,000
State Highways	0.00	$0
US Highways	0.00	$0
US Interstates	0.00	$0
Power Lines	1.46	$70,489
Gas Lines	0.00	$0

5. Problem Soil

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
		Limited	10-25%
	X	Critical	25-50%
		Catastrophic	More than 50%
Probability	X	Highly Likely	
		Likely	
		Possible	
		Unlikely	
Location	See map in Section H.		
Seasonal Pattern or Conditions	Dependant on geology of county.		
Duration	Constant problem		
Analysis Used	Reviewed information and maps provided by County soil classification books, UGS, DESHS, AGRC, and local input.		

Description of Location and Extent

Carbon County has ongoing problem soil issues. Problem soils pose challenges to construction, utility trenching, and agriculture. The county contains large quantities of compacted mancos shale, as well as soils with high alkali content. Problem soil occurrences are high within the whole county (Refer to the map titled "Carbon County Problem Soils" at the end of this section to identify the location and/or geographic extent).

Vulnerability Assessment

Using the problem soils and major roadways map from DESHS, developed for the State of Utah and Census 2000 block data, the two maps were overlaid to indicate where households and roadways exist in relation to problem soil areas. The results from the analysis are presented in Tables 7-11, 7-12 and 7-13. The map "Carbon County Problem Soils " shows the areas of Problem Soils within Carbon County. The assessed values are considered to be high due to the fact that problem soils were taken into account during construction of most structures.

Table 7-11 Problem Soil Areas and Households within Municipal Boundaries

City Name	Acres within City Boundaries	Households in Problem soil area	Assessed Value
East Carbon/Sunnyside	1730	295	$23,197,915
Helper	857	890	$69,986,930
Price	1450	1961	$154,207,157
Wellington	698	788	$61,965,956

Table 7-12 Businesses in Carbon County located on Problem Soil Areas

City Name	Number	Annual Sales
Helper	76	$35,600,000
Price	287	$445,500,000
Sunnyside	10	$7,100,000
Wellington	36	$67,800,000

Table 7-13 Roadways in Carbon County located on Problem Soil Areas

Roadway	Miles	Estimated Replacement Cost
200 West	0.32	$639,489
4500 N Kenilworth Rd.	0.14	$281,561
Bryner Canyon	1.07	$2,147,590
Carbon Ave	4.15	$8,291,669
Front St.	0.35	$706,928
Highway 10	4.57	$9,132,011
Highway 6	2.31	$4,623,593
Ivy Street	0.16	$319,240
		$0
		$0
		$0
		$0
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Kenilworth Rd	3.14	$6,284,346
Main Street	3.75	$7,492,319
Mill Street	0.14	$271,514
Spring Glen Rd	1.48	$2,968,355
State Highway 290	1.62	$3,239,574
State Route 10	3.56	$7,122,959
State Route 122	9.43	$18,865,779
State Route 123	11.65	$23,296,467
State Route 124	6.02	$12,041,025

State Route 139	0.70	$1,390,961
State Route 264	5.84	$11,681,174
State Route 55	0.98	$1,959,904
State Route 96	13.22	$26,439,169
Total	**119.65**	**$149,195,626**

6. Infestation

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
	X	Limited	10-25%
		Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
	X	Likely	
		Possible	
		Unlikely	
Location	Agricultural lands, Forested areas, areas of extreme drought, countywide.		
Seasonal Pattern or Conditions	Summer months, related to drought.		
Duration	Months to years		
Analysis Used	Reviewed information provided by UGS, DESHS, AGRC, Idaho's Forest Health Protections agency, Utah Forestry Fire and State Lands, Utah Forest Service, Utah State University Extension Service, and local input.		

Description of Location and Extent

In the past, Carbon County has been infested with numerous destructive insect species. Surveyors from Boise, Idaho's Forest Health Protection did a study based on infestation in Utah's forests. With help from the Forest Health Coordinator from Utah FFSL the following information was made available. Carbon County has 1,000 acres currently (May 2003) infested with grasshoppers. This infestation is due to Utah's drought, which started in 1999. Because of the amount of forested lands within the county, infestation risk potential is countywide. Drought weakens tree species rendering them more susceptible to disease; as the drought continues the probability of infestation also continues. Infestation affects all segments of the economy, particularly agriculture. Infestation once in place can last several months, even years.

In 1998, 4% or approximately 99,000 acres of Carbon County's total of 985,294 acres was surveyed. Of the 39,500 acres surveyed it was determined that the Douglas Fir Beetle affected 15 acres, the Spruce Beetle affected 119 acres.

In 1999, 10% or 98,529 acres of the county's total acres were surveyed, the Douglas Fir Beetle affected 65 of the surveyed acres, the Spruce Beetle affected 102 acres, and the Sub-Alpine Fir Complex affected 30 acres.

In 2000, 14% of Carbon County's total acreage was surveyed. The Mountain Pine Beetle affected 42 acres of ponderosa, 299 acres of Douglas Fir, and 184 acres of Spruce. The Fir Engraver Beetle infested 40 acres of Sub Alpine Fir Complex; and Aspen Discoloration affected 30 acres.

In 2001, 16% of Carbon County's acres were surveyed. The Mountain Pine Beetle Ponderosa affected 47 acres, the Douglas Fir Beetle affected 486 acres, the Spruce Beetle affected 1,238 acres, the Fir Engraver Beetle affected 39 acres, the Sub Alpine Fir Complex affected 2,356 acres, and Aspen Discoloration affected 246 acres.

In 2002, 26% of Carbon County's total acres were surveyed and the Mountain Pine Beetle Ponderosa affected 88 acres, the Douglas Fir Beetle affected 742 acres, the Spruce Beetle 539 acres, the Fir Engraver Beetle infested 75 acres, and the Sub Alpine Fir Complex affected 141 acres.

Vulnerability Assessment

Potential loss estimates were unable to be completed during the making of this plan due to the lack of digitized datasets related to infestation. Future studies and maps need to be completed to fully understand this hazard.

F. Hazard History

Identifying past hazard events is key in predicting where future events are likely to occur. The following available relevant information such as date, location, area impacted, and damage costs are identified in the table below (Table 7-14). Due to the frequency and geographic extent of problem soil, and some severe weather events past events have not been recorded and are therefore not identified in the table below.

Table 7-14 Hazard Histories

Hazard	Date	Location	Critical Facility/ Area Impacted	Comments
Drought	1930-1936	Countywide	Municipal and agricultural water supplies.	Resulted in the construction of reservoirs, development of groundwater resources, and improved land management.
Drought	1953-1965	Countywide	Agriculture	10-25 year recurrence interval period.
Earthquake	August 2, 1968	Hiawatha		Richter magnitude 3.5
Earthquake	November 17, 1968	Wattis		Richter magnitude 4.6
Earthquake	June 11, 1971	Near Scofield		Richter magnitude 3.2
Earthquake	April 14, 1972	South of Sunnyside		Richter magnitude 3.6
Earthquake	August 10, 1973	West of Sunnyside		Richter magnitude 3.0
Drought	1974-1978	Countywide	Agriculture	10-25 year recurrence interval period.
Earthquake	1985-1986	County	Minor structure damage, no deaths.	
Flash Flood	August 6, 1901	West of Scofield	Winter Quarters. 2 deaths and property damage.	
Flood	1911		Structural damage.	
Flood	September 18, 1919	Helper City. Lost Creek	Price River flooded the city of Price to the canyon mouth above the city of Helper.	Cloudburst storm. Greatest recorded flood in county history with a discharge greater than 12,000 cfs. 200-year event.
Flash Flood	August 16, 1928	Nine Mile Canyon, West of Price City	1 death, property damage.	
Flash Flood	July 29, 1937	Price City	1 death, 3 injuries, property damage.	
Flood	September 12, 1939	Wellington City	Infrastructure damage	
Flood	September 13, 1940	Price/Helper	Homes, farmlands, and streams flooded. Roads blocked. Soldier Canyon closed due to sliding. Helper accumulated $10,000 in damage.	Heavy Cloudburst
Flood	August 5, 1942	Helper City. Price River.	Damage to homes, roads, rail-lines, mines,	

			and bridges. $75,000 damage.	
Flood/ Debris Flow	August 5, 1947	Sunnyside City	1 death, property damages.	
Flash Flood	August 5, 1948	Sunnyside City	1 death, property damages.	
Flood	July 17, 1953	Price City. Willow Creek Canyon	Property and road damage.	
Flood	July 5, 1961	Price City	Property and road damage.	
Flood	July 28, 1968	Spring Glen/ Kenilworth	Property and road damage.	Spring Glen water line and main street damage.
Flood	September 13, 1970	Price/ Helper. Price River and Willow Creek.	Property damage, agricultural losses, railroad lines blocked, $10,000 in damage in Helper City	
Flood	1983	Countywide- Presidential Declaration	Thistle landslide created severe economic loss of $7 million. Road, property, water, culvert, and sewer line damage.	Price River.
Flood/ Mud and Debris Flow	May 13, 1984	Clear Creek	1 death, property damage.	
Earthquake	August 14, 1988	Epicenter at San Rafael Swell, Emery County.	Impacted almost all of Carbon County.	Richter magnitude 5.3
Flood	1996	Wellington City. Center Street and Main Street.		Cloudburst storm. Flooded sewer mains and basements. $100,000+
Drought	1999-present	Countywide	Agriculture and Industry.	
Flood	2002	Wellington City. Main Street and 800 East to 1600 East.		Cloudburst storm
Severe Weather: Wildfire	2002	Price Canyon	3 miles north of Price Canyon	
Severe Weather: Infestation	May, 2003	County	1,000+ acres	Grasshoppers. Related to drought.

G. Mitigation Goals, Objectives, and Actions

Mitigation Strategies Workbook
Carbon County

Note: Countywide in this document refers to a mitigation strategy benefiting the cities, towns and communities of: Solider Summit, Scofield, Colton, Spring Glen, Kenilworth, Carbonville, Wattis, Hiawatha, Helper, Price, Wellington, East Carbon, Sunnyside, and Clear Creek

WILDLAND FIRES

Countywide Problem Identification
Wildfire can significantly impact identified areas and communities in Carbon County.

Goal 1 – Priority HIGH

Objective 1 - Decrease fuel potential in areas if western Carbon County
Action: Remove dead and diseased trees
Time Frame: Ongoing
Funding: Private
Estimated Cost: Sale of trees will generate income
Staff:
Background:

Goal 2 – Priority HIGH

Objective 1 - Maintain adequate fire breaks between wildfire zones and residences in East Carbon County
Action 1: Secure up-to-date property mapping
Time Frame: Ongoing
Funding: None
Estimated Cost: Unknown
Staff: City staff to include; County Assessor, Recorder, and GIS Specialists
Background:

Action 2: Build roads between fire interface zone and residential areas
Time Frame: 6 months
Funding: City funds
Estimated Cost: Unknown
Staff: City staff and public works staff
Background:

Countywide Problem Identification
Urban contiguous fire impact lives and property in the county.

Goal 1 – Priority MEDIUM

Objective 1 - Prevent fire hazards within city limits
Action 1: Review building codes
Time Frame: Immediately
Funding: None
Estimated Cost: Minimal
Staff: Local

Background:

Action 2: Install parapets on building tops
Time Frame: Extended
Funding: Private
Estimated Cost: Unknown - Variable
Staff: Contract
Background:

DAM FAILURE

Countywide Problem Identification
National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest account for 34% of all dam failures. Foundation defects, including settlement and slope instability, account for 30% of all failures. Piping and seepage cause 20% of national dam failures. This includes internal erosion caused by seepage, seepage and erosion along hydraulic structures, leakage through animal burrows, and cracks in the dam. The remaining 16% of failures are caused by other means.

Goal 1 – Priority HIGH

Objective 1 - Lives and property from dam failure inundation risk. Prevent or mitigate damage and loss of life from Scofield Dam failure.
Action 1: Install Remote Warning System building codes
Time Frame: Immediately
Funding: None
Estimated Cost: Minimal
Staff: Local
Background:

Action 2: Maintain periodic testing of dam
Time Frame: Immediate
Funding: State, Federal and Local
Estimated Cost: Unknown
Staff: Federal
Background:

Action 3: Build new bridge to bypass Scofield Dam Road
Time Frame: Undetermined
F**unding:** State, Federal and Local
Estimated Cost: $10,000,000
Staff: State and Local
Background:

Action 4: Construct series of dams on Lower Fish Creek
Time Frame: Ongoing/Extended
Funding: Unknown
Estimated Cost: $5,000,000 each
Staff: Contractor
Background:

Action 5: Construct water holding reservoir in Price Canyon
Time Frame: Begin now with proposals, could take several years
Funding: Unknown
Estimated Cost: $Millions
Staff: Contractor

Background:

Objective 2- Prevent or mitigate damage and loss of life from Grassy Trails Dam failure
Action 1: Install Remote Warning System
Time Frame: One year
Funding: Unknown
Estimated Cost: $30,000
Staff: Contracted
Background:

Action 2: Build riprap dike to redirect flow from Grassy Trails Dam failure
Time Frame: 3 years
Funding: County
Estimated Cost: $100,000
Staff: County employees
Background:

Objective 3 - Protect lives and property from Grassy Trail Dam failure.
Action 1: Obtain funding for engineering, equipment and long-term system maintenance
Time Frame: Unknown
Funding: Unknown
Estimated Cost: Unknown
Staff: City Administrative Staff
Background:

Action 2: Install sensors at dam site and monitor devices at City Offices
Time Frame: 6 months
Funding: Federal Grant
Estimated Cost: Unknown
Staff: Private engineering firm will work with East Carbon and Sunnyside administrations
Background:

Action 3: Monitor dam
Time Frame: Ongoing
Funding: Unknown
Estimated Cost: Unknown
Staff: City Administrative Staff
Background:

Objective 4 - Minimize safety risk and property damage to Sunnyside City from dam failure
Action 1: Construct riprap dike on the east side of Highway 13 from northern Sunnyside City boundary to Sunnyside Park
Time Frame: 1 year
Funding: Federal Grant
Estimated Cost: Unknown
Staff: Private construction firm to work with City
Background:

Action 2: Excavate wash
Time Frame: 1 year
Funding: Federal Grant
Estimated Cost: Unknown
Staff: Private construction firm to work with City
Background:

FLOODING

Countywide Problem Identification
Flooding continues to be of concern in the County and cities and towns within the County. The County experience flooding during spring snow melt and summer thunderstorm season.

Goal 1 – Priority HIGH

Objective 1 - Minimize safety risk and property damage to Carbon County residents due to flooding by establishing, upgrading and maintain structural control measures.

Action 1: Build catch pond on Meads Way
Time Frame: Underway
Funding: City and Federal
Estimated Cost: $100,000
Staff: City staff
Background:

Action 2: Build catch pond on Cardinal Wash
Time Frame: 2 years
Funding: State, County, and City
Estimated Cost: $75,000
Staff: County
Background:

Action 3: Build catch pond on Grassy Trails
Time Frame: 2 years
Funding: State, Federal, County, and City
Estimated Cost: $30,000
Staff: County and City
Background:

Action 4: Excavate wash
Time Frame: 1 year
Funding: Federal Grant
Estimated Cost: Unknown
Staff: Private construction firm to work with City
Background:

Action 5: Increase culvert size on Cardinal Wash at Highway 50-6
Time Frame: 1 year
Funding: Federal Grant
Estimated Cost: $500,000
Staff: UDOT
Background:

Action 6: Excavate wash
Time Frame: 1 year
Funding: Federal Grant
Estimated Cost: Unknown
Staff: Private construction firm to work with City
Background:

Action 7: Enlarge culvert and Pine Street and Edgehill Drive in Sunnyside City
Time Frame: 1 year
Funding: Federal Grant

Estimated Cost: Unknown
Staff: Private construction firm to work with City
Background:

Problem Identification
Reduce economic loss due to flooding

Goal 2 – Priority HIGH

Objective 1 - Promote flood insurance throughout the County
Action: Create outreach document promoting flood insurance and include in local newspaper(s), libraries, and other public buildings.
Time Frame: 1 year
Funding: Minimal
Estimated Cost: Unknown
Staff: County and City Floodplain Administrators, State Floodplain Manager, DES
Background: General public is usual not aware they can purchase flood insurance.

DROUGHT

Countywide Problem Identification
Cyclical periods of drought place a strain on community culinary water resources.

Goal 1 – Priority MEDIUM

Objective 1 - Minimize the loss of life, damage to property and disruption in commerce and governmental services caused by drought through proactive water conservation measures
Action 1: Promote water recycling utilizing secondary water sources
Time Frame: Underway
Funding: State, Federal, And Local
Estimated Cost: Unknown
Staff: City(s)
Background:

Objective 2 - Create new water storage facilities
Action 1: Construct new dam in Garley Canyon
Time Frame: 5 years
Funding: Federal, State, And Local
Estimated Cost: $100,000,000
Staff: Contractor
Background:

Action 2: Construct dam in Willow Creek Canyon
Time Frame: 5 years
Funding: Federal, State, And Local
Estimated Cost: $100,000,000
Staff: Contractor
Background:

Objective 3 - Find new water sources
Action 1: Research the possibility of "cloud seeding"
Time Frame: Immediately
Funding: County
Estimated Cost: $100,000
Staff: Contractor
Background:

Goal 2 – Priority MEDIUM

Objective 1 - Secure adequate water for culinary and agricultural needs of East Carbon and Sunnyside through structural measures

Action 1: Design and build silt control coffers at water inlets at Grassy Trail Reservoir to prevent buildup.
Time Frame: 1 year
Funding: Federal Grant
Estimated Cost: Unknown
Staff: Contractor, private engineering firms to work with cities
Background:

Action 2: Obtain funding to Build Range Creek water delivery tunnel
Time Frame: Unknown
Funding: Unknown
Estimated Cost: Unknown
Staff: Unknown
Background:

Action 3: Tunnel from Range Creek dam site to drop off point
Time Frame: 2 years
Funding: Federal Grant
Estimated Cost: $100,000
Staff: Contractor, private engineering firms to work with cities
Background:

Action 4: Obtain funding to build Range Creek Dam
Time Frame: Unknown
Funding: Unknown
Estimated Cost: Unknown
Staff: City Staff
Background:

Action 5: Construct Range Creek Dam
Time Frame: 5 years
F**unding:** Federal Grant
Estimated Cost: $100,000
Staff: Contractor, private engineering firms to work with cities
Background:

LANDSLIDE

Countywide Problem Identification
There is a potential risk to structures located in areas identified Federal and state agencies and depicted in GIS as landslide risk areas.

Goal 1 – Priority LOW

Objective 1 - Minimize loss of life, damage to property and disruption in residents, commerce and government services caused by landslides through structural measures.

Action 1: Build retaining fences and momentum absorbers along highways
Time Frame: 5 years
Funding: Federal, State, And Local
Estimated Cost: $1,000,000
Staff: UDOT

Background:

Action 2: Dislodge large rocks along highways
Time Frame: Immediate
Funding: Federal, State, And Local
E**stimated Cost:** $100,000
Staff: UDOT
Background:

Action 3: Build retaining walls on residents identified at risk
Time Frame: 5 years
Funding: Individual
Estimated Cost: Variable
Staff: Unknown
Background:

Action 4: Develop pathways to capture falling rocks adjacent to residences
Time Frame: 5 years
Funding: Federal, State, And Local
Estimated Cost: $100,000
Staff: City and County
Background:

PROBLEM SOILS

Countywide Problem Identification
Problem soils are a risk to property and life due to its volatility

Goal 1 – Priority LOW

Objective 1 - Protect roadways
Action 1: Increase width of slope adjacent to roadways
Time Frame: Extended
Funding: Federal, State, And Local
Estimated Cost: Unknown
Staff: State, County, and City
Background:

Action 2: Educate homeowners about problem soil risk
Time Frame: 2 years
Funding: Local
Estimated Cost: $3,000
Staff Local
Background:

Action 3: Monitor and control water on alkali soils
Time Frame: Ongoing
Funding: Local
Estimated Cost: $3,000
Staff: Local
Background:

INFESTATION

Countywide Problem Identification
Infestation of noxious insects and bird species can impact the health, safety and welfare of County and its residents.

Goal 1 – Priority LOW

Objective 1 - Control insects and birds
Action 1: Insecticide spray
Time Frame: Ongoing
Funding: Local
Estimated Cost: $100,000
Staff: Local
Background:

Action 2: Remove dead and diseased trees
Time Frame: Extended
Funding: Private
Estimated Cost: Trees will be harvested by commercial enterprise.
Staff: Private
Background:

Action 3: Pigeon removal
Time Frame: Undetermined
Funding: Federal, State, And Local
Estimated Cost: $15,000
Staff: Local
Background:

SEVERE WEATHER

Countywide Problem Identification
Snowstorms, summer thunderstorms, hail, and high winds over eastern Utah have a dramatic effect on regional commerce, transportation, and daily activity and are a major forecast challenge for local meteorologists.

Priority MEDIUM

Objective 1 - Protect County from adverse affects of severe weather
Action 1: County participates in the Storm Ready program.
Time Frame: 2 Year
Funding: State and Federal
Estimated Cost: Unknown
Staff: City and County Emergency Management
Background: Set up within the county emergency management and encourage all cities to participate, all requirements of the National Weather Service Storm Ready program.

Action 2: Encourage avalanche preparedness for county backcountry users.
Time Frame: 1 Year
Funding: Minimal
Estimated Cost: Minimal
Staff: County Emergency Management State Hazard Mitigation Team members, Utah Avalanche Forecast Center.
Jurisdictions: Countywide
Background: Avalanches and avalanche preparedness is not often considered when discussing mitigation on the county or city level, yet several people die each year in Utah's backcountry. While the avalanche terrain is mainly on US Forest Service land the

search and rescue for the lost individual in more often than not coordinated by emergency managers with search parties comprised of county and city staff. Introductory avalanche awareness training could lessen the costs to Carbon County and the cities within the county. Most avalanche victims die in avalanches started by themselves or someone in there party. Thus, education can limit the number of avalanche related searches each year.

Action 3: Assess EOC's to ensure they are grounded lightning, to include buildings with towers, etc.
Time frame: 2-3 years
Funding: Federal Grants
Estimated Cost: Unknown
Staff: County Emergency Management
Jurisdictions: Countywide
Background: Proposed alternate Command Centers (Public Works, Public Utilities), Sheriff's Dispatch, Command Vehicle(s) and associated equipment need to be protected from severe weather events including lightning.

HAZARDOUS MATEIALS

Countywide Problem Identification
Highway 6 is one of the main arteries going east and west in the State. In most places this is a two-lane highway that experiences numerous accidents and hazardous material incidents.

Goal 1 – Priority Medium

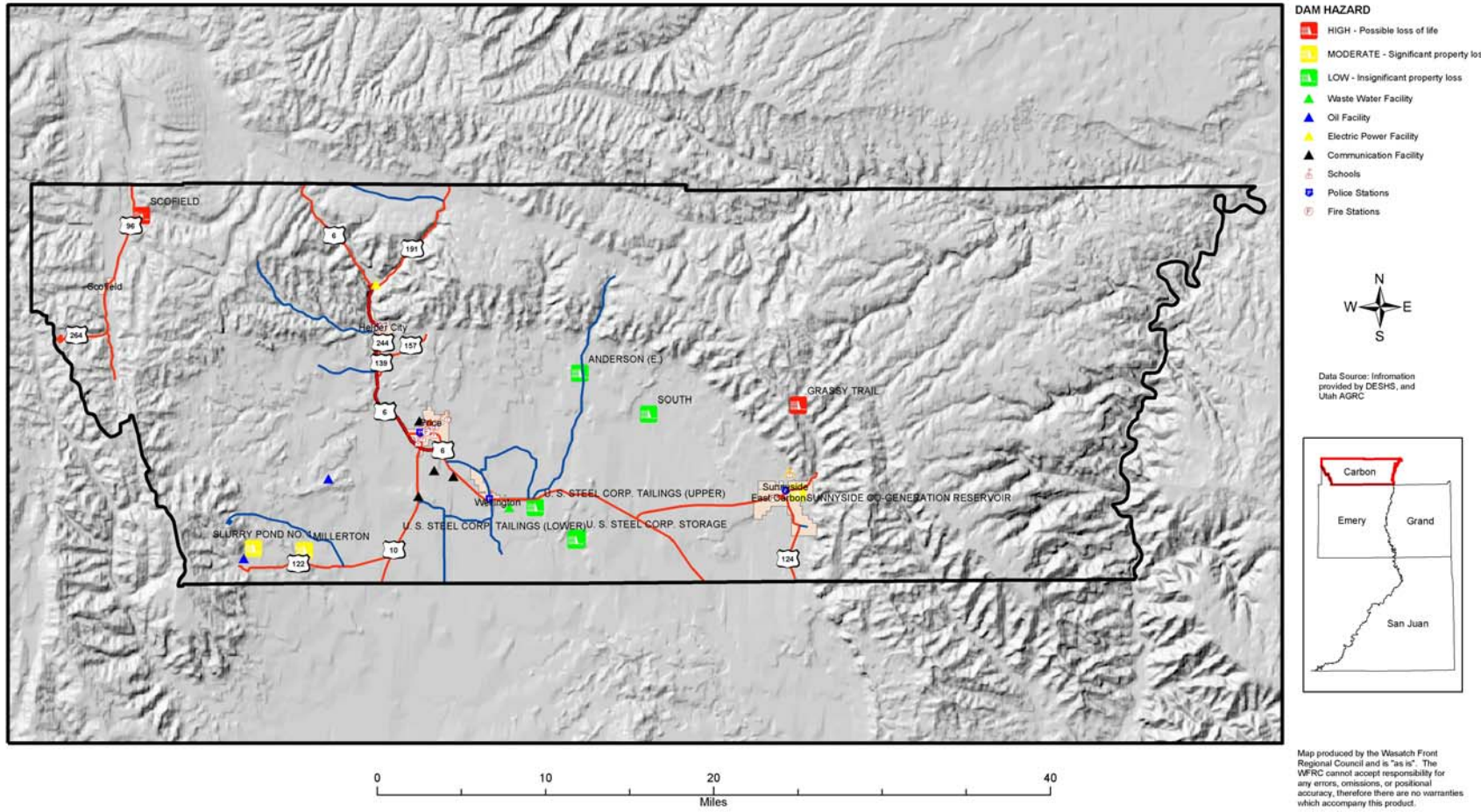
Objective 1 - Protect lives and property from hazardous materials spills.
Action 1: Work with County LEPC to help identify hazardous materials traffic on Highway 6
Time frame: Ongoing
Funding: Federal Grants
Estimated Cost: Unknown
Staff: County Emergency Management/LEPC, State HMI
Jurisdictions: Countywide
Background:

H. Maps

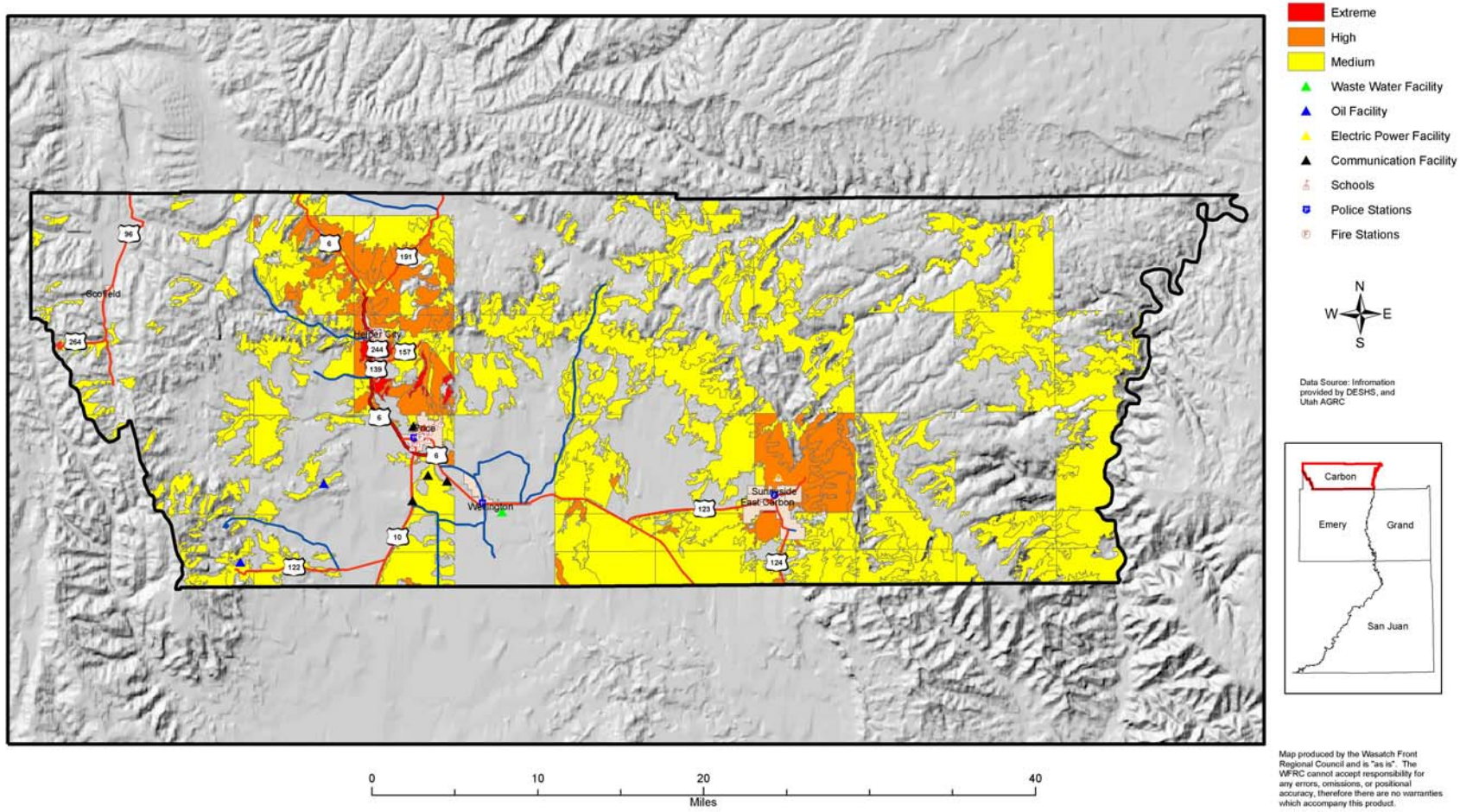
All of the following maps have been created for the purposes related to PDM using the best available data. WFRC and its staff members cannot accept responsibility for any errors, omissions, or positional accuracy; As such, there are no warranties, which accompany the maps.

Map 7.1.1 Dam Hazard
Map 7.3.1 Wildfire Risk
Map 7.4.1 Landslide Hazard
Map 7.5.1 Problem Soils
Map 7.9.1 Earthquake Hazard

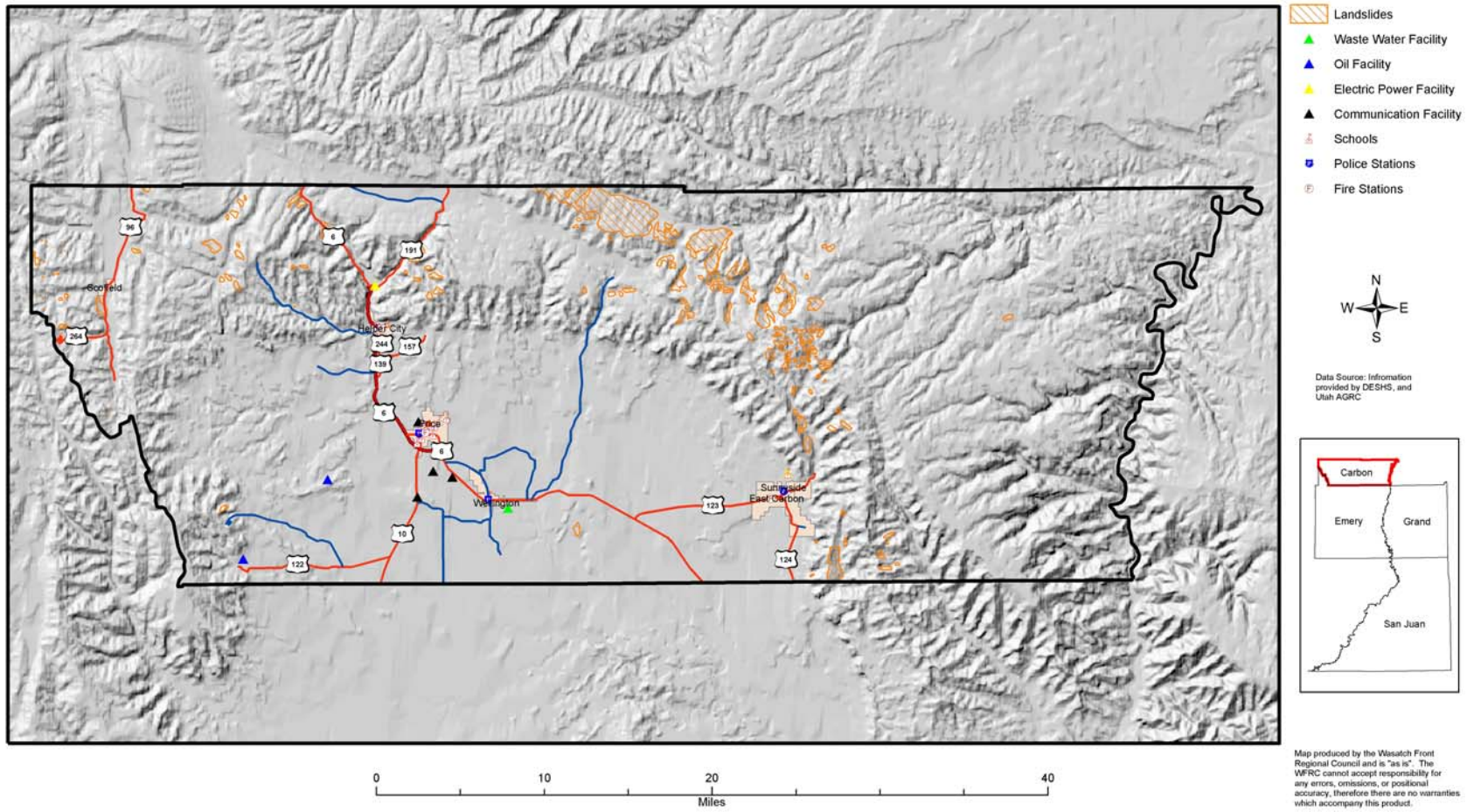
Carbon County Dam Hazard



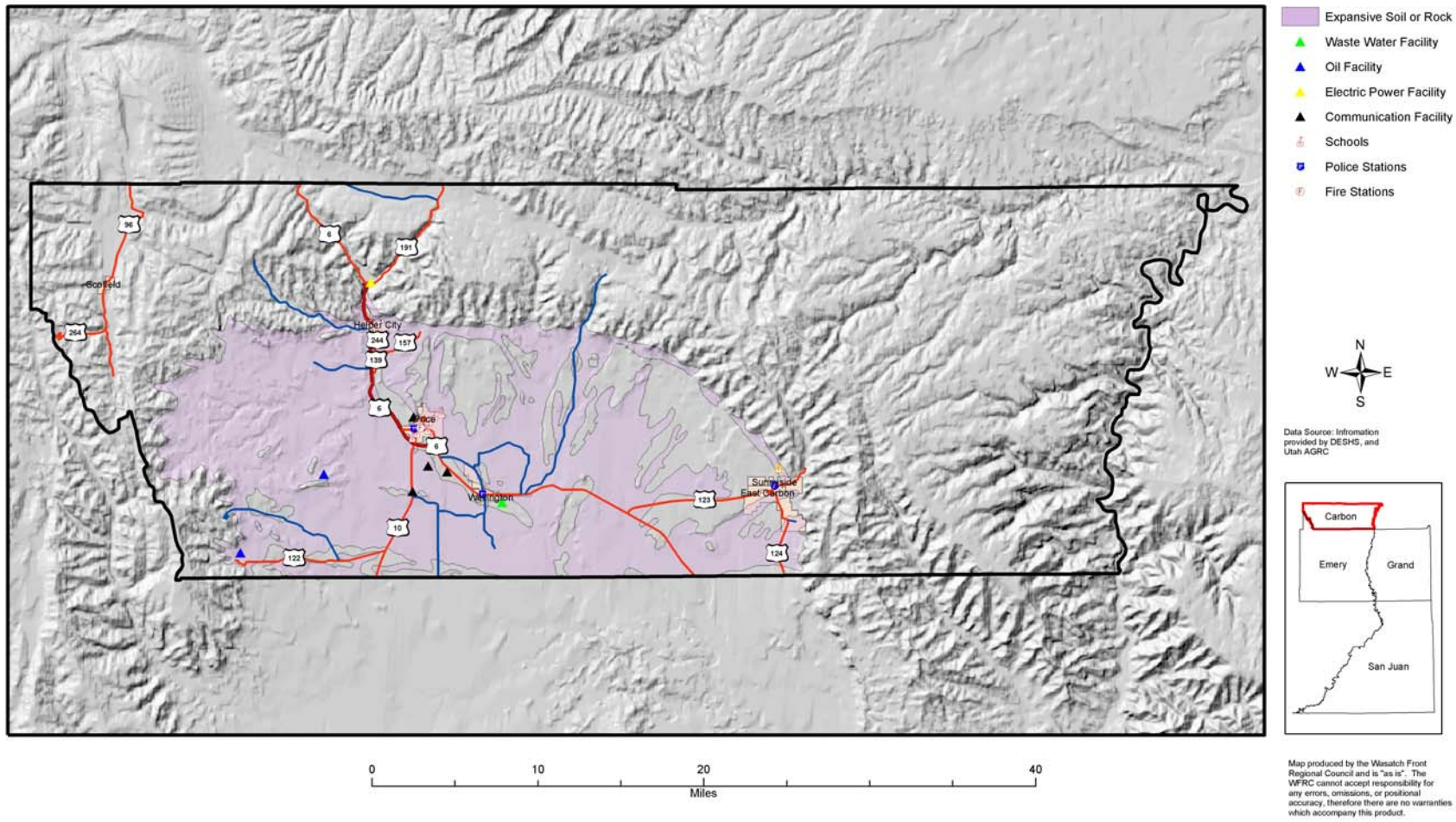
Carbon County Wildfire Risk



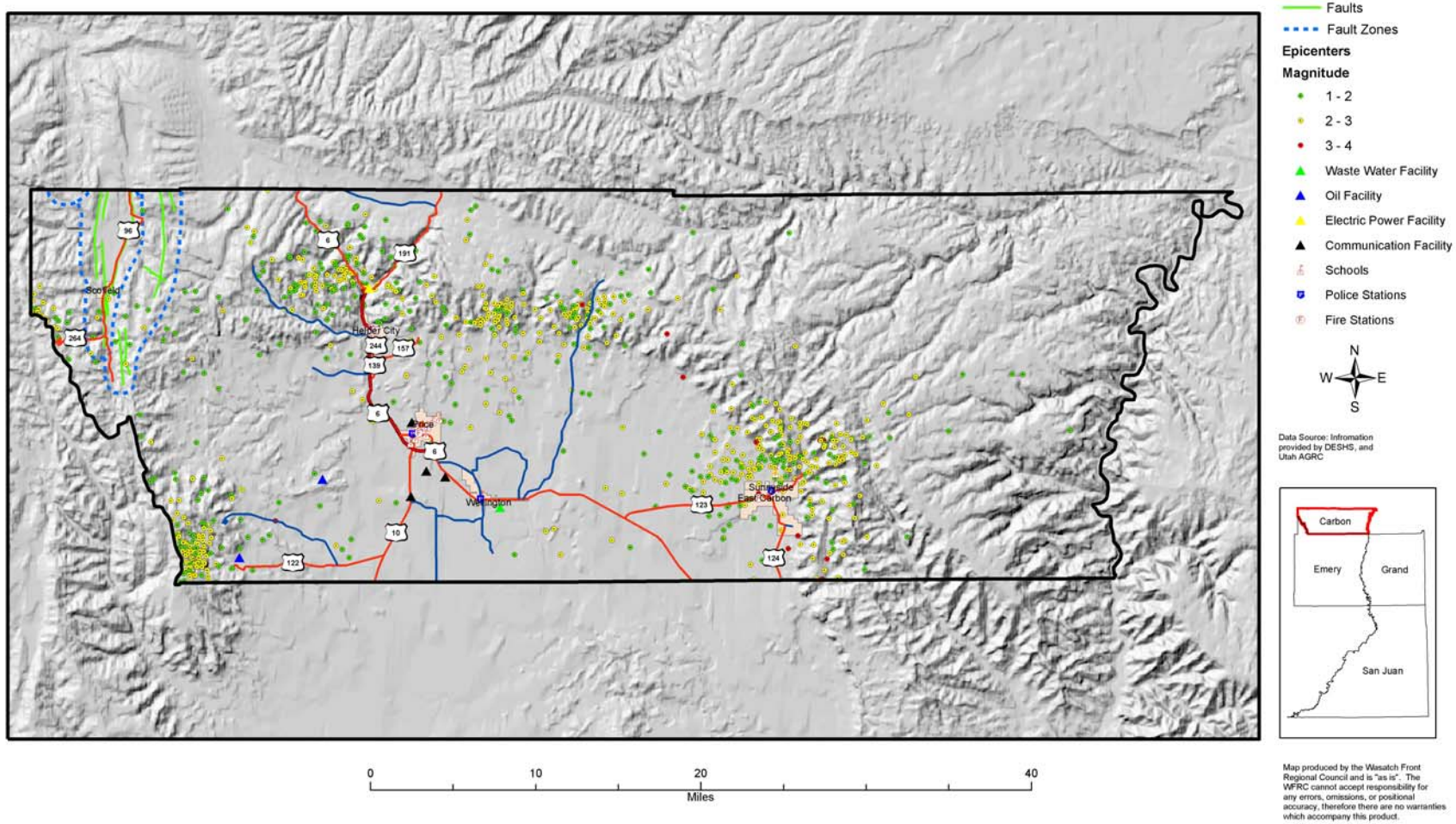
Carbon County Landslide Hazard



Carbon County Problem Soils



Carbon County Earthquake Hazard



Part 8. Emery County

Emery County includes nine municipalities: Castle Dale City, Clawson Town, Cleveland Town, Elmo Town, Emery Town, Ferron City, Green River City, Huntington City, and Orangeville City. Emery is located in the southeastern portion of the state.

A. Demographics and Population Growth

The following information involving Population Estimates, Average Annual Rate of Change, and Population and Development Trends is important in understanding the impacts that a natural hazard may have on a local community (Table 8-1). Population numbers also identify the constancy of a community's population inflow and outflow data.

Table 8-1 Emery County Population

	Emery County	Castle Dale city	Clawson town	Cleveland town	Elmo town	Emery town	Ferron city	Green River city	Huntington city	Orangeville city	Balance of Emery County	Southeast Region
1980 Census Population	11,451											54,124
1990 Census Population	10,332	1,704	151	498	267	300	1,606	881	1,875	1,459	1,591	49,801
2000 Census Population	10,860	1,657	153	508	368	308	1,623	973	2,131	1,398	1,741	
2005 Population Projections	10,667											
2010 Population Projections	11,103											
2015 Population Projections	11,906											
2020 Population	12,455											

Projections												
2030 Population Projections	12,438											
1990-2000 % AARC	0.5 %	-0.3%	0.1%	0.2%	3.3%	0.3%	0.1%	1.0%	1.3%	-0.4%	0.9%	
2000-2030 % AARC	0.45%											0.75%
1990-2000 Percent Change	5.1%											
Rank by 2000 Population	19											
Rank by Percent Change	28											
Rank by AARC	28											

Source: Bureau of the Census, 2002 Baseline Projections, and Utah Population Estimates Committee. Governor's Office of Planning and Budget. 1980 and 1990 populations are April 1 U.S. Census modified age, race and sex (MARS) populations; 2000 populations, household sizes and households are April 1 U.S. Census summary file 1 (SF1) populations; all others are July 1 populations. Note AARC is average annual rate of change.

B. Economy

Emery County's economy struggled in 2002 with non-farm employment falling during the first two quarters; non-farm jobs dropped 4.0 percent in the first quarter and 1.5 percent in the second. The coal mining industry also lost jobs, as did utilities. Construction positions gave the economy a slight boost and manufacturing jobs were basically unchanged. Trucking, information, and local government employment, as well as retail and wholesale trade all saw a slight decline, while federal land management jobs increased. Emery County's economy will likely continue to struggle into 2003 with the national recession and uncertainty over energy prices while the construction and telecommunications growth will continue to provide a buffer to overall job losses (Emery County Trends). The 2000 estimated average house value is $82,909 (Annual Statistical).

C. Transportation and Commuting Patterns

The principle east-west corridor through Emery County is Interstate Highway 70. United States Highways 191 and 6 are main highways for both north-south traffic between Salt Lake City and southeastern Utah, and east-west traffic between Salt Lake City and Denver, Colorado. Along State Highway 10, between Price and Emery, lay the majority of the population of Emery County. Highway 10 is located on the east bench of the Wasatch Range. The Burlington Northern Santa Fe (BNSF) Railroad runs roughly parallel to US highway 6 and 191 from Green River through Price City (Hazard Analysis, Emery).

D. Land Use and Development Trends

Emery County is Utah's seventh largest county in terms of land area. Emery County encompasses 4,445 square miles of land of which 83% is federally owned, 10% is state owned, and 7% is privately owned.

The housing market has changed little in the last five years; the primary change has been an improvement in housing availability. From the fourth quarter of 2000 through the third quarter of 2001, housing costs increased by less than 2% district wide, with Grand County costs driving the increase. During this same period the average home cost in the Carbon and Emery County area sold for $86,376. In Grand and San Juan the average cost of a home through the third quarter of 2001 was $123,827.

Commercial housing development within the district continues to be practically non-existent. Lots are generally sold one at a time to a family that builds and then lives in the home. There is not a demand for the housing development that is seen in the faster growing urban corridor of the state. Also, development of larger multi-family projects is practically non-existent.

E. Risk Assessment

The risk assessment identified the following hazards in Emery County: Drought, Dam Failure, Flood, Earthquake, Severe Weather, and Landslide. Risk assessment maps were completed for the mapped hazards and can be viewed at the end of this section. Refer to maps and Part 6 for an explanation of the risk assessment process. According to this data there are a total of 21 identified critical facilities within Emery County, for the complete list refer to Appendix C.

Representatives from each Emery County jurisdiction contributed to the risk assessment analyses of each hazard within the identified hazard boundary (Section E). Drought, Earthquake, and Severe Weather are regional hazards and have been profiled as such (Part 4 Regional Data).

1. Dam Failure

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
	X	Limited	10-25%
		Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
		Likely	
	X	Possible	
		Unlikely	
Location	See map in Section H Dam locations are mainly in the Mid- to northwestern portion of the county.		
Seasonal Pattern or Conditions	Rainy Day Failure happens mainly during heavy precipitation events, can have some warning time. Sunny Day Failure happens with no warning at all can happen at anytime.		
Duration	Hours, Days. Depends on spillway type and area, maximum cfs discharge, overflow or breach type, dam type. Refer to Dam Inventory for more information.		
Analysis Used	Review of BOR inundation maps and plans, FIS, Water Rights.		

Description of Location and Extent

Hazard ratings are determined by downstream uses, size, height, volume and incremental risk/damage assessments. The hazard ratings are: Low-insignificant property loss; Moderate- significant property loss; High- possible loss of life. It should be noted, dam safety hazard classifications are in the event of dam failure and are based upon the consequences of dam failure, the classification of a high hazard dam does not mean that the dam has a high probability of failure.

Table 8.4 Emery County Dam Risk

Dam Name	Hazard	Acre-Feet Storage Capacity
1. BOR Huntington North	High	5,420
2. BOR Joes Valley	High	62,500
3. Cleveland	High	5,340
4. Miller Flat	High	5,560
5. Millsite	High	18,000
6. Utah Power and Light- Electric Lake	High	31,500
7. Castle Valley - Emery Town LWR	Moderate	N/A
8. Castle Valley - Emery Town UPR	Moderate	N/A
9. Castle Valley SP SVC DST- Orangeville	Moderate	N/A
10. Duck Fork	Moderate	N/A
11. Ferron Debris Basin No. 4	Moderate	N/A
12. Ferron Debris Basin No. 5	Moderate	N/A
13. Nielson (John)	Moderate	N/A
14. Potters Pond No. 1	Moderate	N/A
15. Potters Pond No. 2	Moderate	N/A
16. Utah Power and Light- Huntington	Moderate	N/A
17. Utah Power and Light- Huntington Set.	Moderate	N/A
18. Wilberg #1 (Northern)	Moderate	N/A
19. Wilberg #2 (Old Dam)	Moderate	N/A
20. Wilberg #3 (New Dam)	Moderate	N/A
21. Wrigley Springs	Moderate	N/A

* N/A – Not Applicable, none known at this time.

Castle Dale and Orangeville
The Joe's Valley Reservoir was inspected by the Bureau of Reclamation in July of 1990 and was classified to be a high downstream hazard to Orangeville and Castle Dale due partly to the faults that run directly under the reservoir contained by the dam.

Castle Valley Special Service District-Orangeville dam has a moderate hazard rating. It was built in 1983 and is owned by the Castle Valley Special Service District. It has 23 acre-feet reservoir storage at spillway crest and a maximum dam breach flow of 2,000 cfs in a 0.1 square mile drainage basin area. The first downstream town is Orangeville, located just 1 mile away. Castle Dale is just downstream and adjacent to Orangeville to the southeast

Ferron
The Millsite Reservoir was built in 1971 and modified in 1998. This reservoir has a high hazard rating and is owned by the Ferron Canal and Reservoir Company. The reservoir storage at spillway crest is 18,000 acre-feet and the storage at the dam crest is 20,000 acre-feet. The maximum discharge is 5450 cfs and the maximum dam breach flow would be 258,000 cfs. The first downstream town is Ferron located 3 miles away.

The Ferron Debris Basin No. 4 has a moderate hazard rating. This dam was built in 1970 and owned by Ferron Canal and Reservoir & Company. The reservoir storage at spillway crest is 44 acre-feet and the reservoir storage at dam crest is 61 acre-feet. The maximum dam breach flow is 7,000 cfs in a 1 square mile drainage basin area. The first downstream town, Ferron, is only 2 miles away.

The Ferron Debris Basin No. 5 has a moderate hazard rating. The dam's owner is Ferron Canal and Reservoir & Company and the dam was completed in 1970. The reservoir storage at spillway crest is 65 acre-feet with a 207 acre-feet storage area at the dam crest. Maximum dam breach flow would be 10,000 cfs in a 2 square mile drainage basin area. The spillway maximum discharge is 2080 cfs. The downstream town of Ferron is only 1 mile away.

Huntington
Cleveland Reservoir was built in 1909 and modified in 1985. The dam has a high hazard rating and the owner is Huntington-Cleveland Irrigation Company. The reservoir storage at spillway crest is 5340 acre-feet and the storage at dam crest is 6020 acre-feet. The spillway maximum discharge is 2446 cfs and the maximum dam breach flow would be 74,000 cfs in a 9 square mile drainage basin area. The first downstream town is Huntington, 25 miles away.

The Miller Flat Reservoir was built in 1948 and modified in 1985. The dam has a high hazard rating and the owner is Huntington-Cleveland Irrigation Company. The reservoir storage at spillway crest is 5560 acre-feet and the storage at dam crest is 6393 acre-feet. The spillway maximum discharge is 2000 cfs and the maximum dam breach flow would be 99,000 cfs in a 9 square mile drainage basin area. The first downstream town is Huntington, 24 miles away.

The Utah Power and Light- Electric Lake was built in 1974 and has a high hazard rating. The reservoir storage at spillway crest is 31,500 acre-feet and the storage at dam crest is 35,500 acre-feet. The spillway maximum discharge is 2,300 cfs and the maximum dam breach flow would be 175,000 cfs in a 30 square mile drainage basin area. The first downstream town is Huntington, 24 miles away.

Vulnerability Assessment
We were able to overlay municipalities, roads, and critical facilities atop dam identification layers provided by DESHS using GIS to identify the location of the water reservoirs. Refer to the map titled "Emery County Dam Hazard" for the location of the reservoirs listed in Table 8.4 below. In the following narrative downstream towns have been identified that could be potentially affected if a dam were to breach. However, we were unable to evaluate potential dam failure dollar losses due to lack of credible dam inundation map data. The Utah Dam Safety Section is currently working on updating and digitizing dam failure inundation areas for all of the states high hazard dams. It is expected that future revisions of this plan will include these maps.

2. Flood

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
	X	Limited	10-25%
		Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
		Likely	
	X	Possible	
		Unlikely	
Location	See map in Section H, mainly the major rivers of the Green River and the San Rafael.		
Seasonal Pattern or Conditions	Spring, Cloudburst Storms and Heavy Snowfall Runoff.		
Duration	Flooding can last anywhere from hours to days and even months.		
Analysis Used	Review of FIS, FIRM, Army Corp of Engineers Flood Study, Hazard Analysis Plans, GIS data		

Description of Location and Extent

Areas, outside the countywide threat that could be affected if there were heavy snowmelt and/or dam failure include farmland along the east bench of the Wasatch Plateau. The towns of Castle Dale, Cleveland, Emery, Ferron, Huntington, Orangeville, and Green River are the most susceptible. Canal systems, such as the earthen Clipper, Western and the Mammoth canals could threaten Orangeville. The Joes Valley Canal, also known as the Cottonwood Creek- Huntington Canal (a 5-mile membrane and 12 mile earthen canal) could affect Orangeville, Huntington, and Castle Dale.

Vulnerability Assessment

We were unable to assess vulnerability in terms of potential losses due to the lack of digital floodplain maps. Because we recognize the need to understand flood vulnerability and to have digitized flood maps, this process of obtaining GIS-compatible data has been included as one or our mitigation actions.

A rudimentary Flood Hazard Identification Study has also been compiled by the Army Corps of Engineers in 2003, addressing areas previously (and sometimes erroneously) identified as *"No Special Flood Hazard"* as well as unmapped jurisdictions in Emery County (Appendix E).

3. Landslide

Hazard Profile

Potential Magnitude	X	Negligible	Less than 10%
		Limited	10-25%
		Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
		Likely	
	X	Possible	
		Unlikely	
Location	See map in Section H. Generally occur in canyon mouths and foothill areas.		
Seasonal Pattern or Conditions	Spring and Summer usually caused by the stress release of over-weighted soils and or loosening of rock and debris.		
Duration	Landslides generally last hours or days, but some can last weeks.		
Analysis Used	Information and maps provided by UGS, DESHS, AGRC.		

Description of Location and Extent

Recorded landslides have taken place primarily in the northern portion of the county within Black Butte, Red Plateau, Buckhorn Flat, and Cleveland Lloyd Dinosaur Quarry. Other areas include the northern most tip of the county as well as in the lower western portion near the Coal Cliffs and Molen Reef. Landslides generally occur in well-defined, localized areas, but are not always identifiable and can have countywide impacts.

In 1983, a major landslide event took place in the Town of Thistle outside of Emery County, but severely impacted the county economy. The Thistle slide destroyed the major highway and railroad connecting Eastern Utah with the Wasatch Front. To date the Thistle Landslide has been the most expensive landslide in the United States.

Vulnerability Assessment

The hazard analysis indicates that there are no business or critical facilities in Emery County that are located within the high landslide risk area. Refer to Table 8-5 for the infrastructure damage related to landslides.

Table 8-5 Infrastructure in Landslide Area

Item	Length (Miles)	Replacement Cost
Local Roads	3.80	$7,600,000
State Highways	0.00	$0
US Highways	0.00	$0
US Interstates	0.25	$900,000
Power Lines	0.26	$12,553
Gas Lines	0.00	$0

*There are no known residences, businesses or population located in landslide risk areas in Emery County.

F. Hazard History

Within the mitigation planning process it is important to remember that knowledge of the past is the key to planning for the future. Identifying past hazard events is key in predicting potential location of future hazards. Included in Table 8-6 are hazard events with as much relevant information as was available including date, location, area impacted, and damage costs.

Table 8-6 Hazard Histories

Hazard	Date	Location	Critical Facility/ Area Impacted	Comments
Hail	9/29/1951	Emery County	Highway 10 flooded	Heaviest hailstorm recorded in US.
Cloudburst	08/26/1952	Castle Dale	Buckhorn Wash	1 death
Flood	07/19/1957	Castle Dale	Buckhorn Flat Road	Considerable road damage
Flood	08/08/1957	Castle Dale/ Orangeville City		Flood damage to homes, crops, and streets
Tornado	05/04/1961	Emery City		3k in property damage
Cloudburst	08/25/1961	Moore	Emery Canal, Muddy Creek	Farmland and canal damage
Hail	09/08/1961	Emery City		1” magnitude
Flash Flood	09/21/1962	Woodside	Saleratus Wash	Destroyed section of Highway 6 and railroad track
Flood	08/ 1-2/1964	Orangeville City	Cottonwood Creek	Farmland, canal, and road damage $17,500
Flood	07/25/1965	Emery	Ivie Creek	Farmland, bridge, and irrigations facilities damage
Tornado	05/09/1966	Emery City		
Earthquake	04/03/1967	Emery County	Northwest of Huntington	Richter magnitude 3.4
Flood	05/25/1967	Orangeville City	Clipper Canal	Highway 59 flooded, home and canal damage
Cloudburst	07/17/1967	Green River		Farmland, bridge, and crop damage
Flash Flood	07/23/1967	Ferron City	South Straight Hollow and Dutch Flat Wash	Canal, road, and construction project damage
Cloudburst	08/8-9/1967	Ferron City	Dutch Flat Canal	Ferron watershed project and road damage
Tornado	11/02/1967	Emery City		F2, 25k in property damage
Thunderstorm	07/30/1968	Ferron City	Molen Steeps Wash, Dry Wash	City culinary water system, roads, irrigation flumes damaged and destroyed
Cloudburst	08/01/1968	Ferron City	North Canal	Farmland, road, business damage
Storm	09/09/1969	Huntington City	Huntington Canyon	Damage irrigation systems and crops,

				about $20,000.
Earthquake	08/20/1971	Emery County	North of Green River	Richter magnitude 3.1
Earthquake	04/17/1972	Emery County	San Rafael Swell	Richter magnitude 3.1
Earthquake	11/15/1972	Emery County	Near Emery	Richter magnitude 3.1
Thunderstorm/Wind	03/31/1978	Emery City		50kts.
Thunderstorm/Wind	07/21/1984	Emery City		55kts.
Hail	08/30/1986	Emery City		1.00 inch
Earthquake	8/18/1988	San Rafael Swell	Buckhorn	Richter magnitude 5.3
Earthquake	1988	Fish Lake		Richter magnitude 6.0
Hail	09/21/1988	Emery City		1.00 inch
Hail	09/21/1988	Emery City		0.75 inch
Earthquake	01/29/1989	South Wasatch Plateau	Between Salina and Freemont Junction	Richter magnitude 5.4
Tornado	07/26/1991	Emery City		F0
Tornado	07/26/1991	Emery City		F0
Heavy Snow	01/11/1993	Emery County		1 injury, 1k in property damage
Heavy Snow	01/29/1993	Emery County-not specific		
Heavy Snow	02/01/1993	Emery County-not specific		
Heavy Snow	02/08/1993	Emery County-not specific		
Heavy Snow	02/16/1993	Emery County-not specific		
Lightning	02/04/1994	Orangeville City		1 injury
Heavy Snow	02/04/1994	Emery County-not specific		
Drought/Heat	06/01/1994	Countywide		
Flash Flood	06/19/1994	Capital Reef		
Flash Flood	06/19/1994	Orangeville City		
Flash Flood	08/11/1995	Ferron City		
Flash Flood	08/23/1995	Huntington City		
Heavy Snow	02/25/1996	Emery County-not specific		1death, 1injury, 10k in property damage
High Wind	03/28/1996	Emery County-not specific		51kts. 17k in property damage
High Wind	12/16/1996	Emery County-not specific		96kts. 6 injury, 100k in property damage
Blizzard	01/11/1997	Emery County-not specific		3 death, 50 injury, 40m in property damage
Hail	06/14/1997	Ferron City		0.75 inch
Flash Flood	07/28/1997	Emery City		40k in property damage
Thunderstorm/Wind	08/12/1997	Green River		61kts. 1 injury, 10k in property damage
Flood	09/13/1997	Ferron City		
Thunderstorm/Wind	09/19/1997	Green River		61kts. 8k in property damage
Heavy Rain	07/28/1998	Green River		45k in property damage, 2k in crop damage
Flash Flood	08/21/1998	Green River		2k in property damage,

				1k in crop damage
Hail	09/29/1998	Ferron		0.75 inch, 1k in crop damage
Winter Storm	10/15/1998	Emery County-not specific		100k in property damage
Winter Storm	11/08/1998	Emery County-not specific		10 injury, 500k in property damage
Winter Storm	12/19/1998	Emery County-not specific		10 injury, 100k in property damage
Extreme Cold	12/21/1998	Emery County-not specific		20 k in property damage
Heavy Snow	04/04/1999	Emery County-not specific		
High Wind	04/15/2002	Emery County		75 kts. 10 injury, 2m in property damage, 100k in crop loss

G. Mitigation Goals, Objectives, Actions

Mitigation Strategies Workbook
Emery County

Note: Countywide in this document refers to a mitigation strategy benefiting the cities, towns and communities of: Huntington, Elmo, Cleveland, Lawrence, Orangeville, Castle Dale, Clawson, Ferron, Emery, Molen, Moore, and Green River.

DAM FAILURE

Countywide Problem Identification
Orangeville and Castle Dale are directly downstream from Joe's Valley Dam and the communities of Cleveland, Emery, Ferron, Green River and Huntington can also be directly impacted from dam failure. Current dam inundation maps may not reflect risk. County should have central location for maps and review on a regular basis

Goal 1: Priority Medium

Objective 1 – Obtain and evaluate inundation maps for all major dams in the County

Action: Obtain funding for engineering in the evaluation of current dam inundation maps
Time Frame: Next five years
Funding: State and Federal grants, dam safety programs
Estimated Cost: Dependent on extend of evaluation
Staff: Contractors, BOR and State Dam Safety
Background: Evaluation of current dam inundation maps is essential for warning and notification systems

Objective 2 – Maintain Communication/Warning Systems for dam failure

Action 1: Evaluate existing warning systems for dam failure
Time Frame: Next two years
Funding: County and State – grants
Estimated Cost: Unknown, probably minimal
Staff: BOR, Dam Engineers, County Emergency Management
Background: Evaluation of current communication and warning systems can be viewed as a base line for future warning and communication needs

Action 2: Install additional warning systems where needed
Time Frame: Next five years
Funding: Unknown
Estimated Cost: Unknown
Staff: County, BOR, State Dam Safety
Background: Development and funding of existing warning systems to include: sirens, reverse 911, satellite phones, and "call down tree"

Action 3: Establish evacuation routes for dam failure
Time Frame: 2 years
Funding: None
Estimated Cost: Minimal
Staff: County Sheriff, City Police, and County Emergency Management
Background: Identified evacuation routes will assist in response to dam failure and help educate public on evacuation measures

Objective 3 – Develop public information on dam failure to include evacuation routes and sheltering plans

Action 1: Identify and maintain access and egress routes throughout the County (SR10/UDOT)
Time Frame: Immediate
Funding: None
Estimated Cost: Minimal
Staff: County Sheriff, City Police, County Emergency Management, School District County Road Dept. and Public Works
Background: Include a map of identified routes for evaluation purposes on County website and in City and County public buildings

Action 2: Establish agreements for emergency shelters
Time Frame: Immediate
Funding: None
Estimated Cost: Minimal
Staff: County Emergency Management, Red Cross, and School District
Background: Pre identifying shelters will assist in evacuation process

DROUGHT

Countywide Problem Identification
Limited water supplies, increasing population and several years of drought place a strain on availability of community culinary water resources and water storage

Goal 1: Priority High

Objective 1: Excessive water used for landscaping

Action: Develop and enforce policies to limit the amount of area that can be used as water requiring landscape.
Time Frame: Ongoing
Funding: Minimal
Estimated Cost: To be determined
Staff: County and Special Service Districts or Water Districts
Background: Emery County has had several years of drought and has at time been unable to supply water to residents on the Manila side of the county.

Objective 2 - Develop more water storage tanks in several areas in the county.

Action: Conduct feasibility study.
Time Frame: 5 years
Funding: Grants
Estimated Cost: Unknown
Staff: Unknown
Background: Water storage is always an issue in times of drought. The ability to adequate store water lessens the impact in areas of the county.

Countywide Problem Identification
Earthen irrigation systems throughout the county.

Goal 2- Priority MEDIUM

Objective 1 - Upgrading irrigation systems.

Action 1: Improve canal in order to have better efficiency of water.
Time Frame: Unknown (depends on funding)

Funding: State and Federal grants and loans.
Estimated Cost: Unknown
Staff: NRCS, UACD, USU Extension, etc. Irrigation Company
Background: Several years of drought and a need for water conservation.

Action 2: Install field sprinkler systems (pressurized, secondary lines)
Time Frame: Ongoing
Funding: Private
Estimated Cost: Unknown
Staff: Private with assistance from Federal agencies
Background: Better usage of agricultural water.

Countywide Problem Identification
Lack of public awareness of efficient water usage.

Goal 3 - Priority HIGH

Objective 1 - Education

Action: Use several ways in educating the public on efficient water usage.
Time Frame: Ongoing
Funding: State, Federal grants, city and county funds, irrigation companies.
Estimated Cost: Minimal
Staff: LEPC, County, Cities and Towns.
Background: Create programs to make the public aware. Use newsletters and the newspapers.

EARTHQUAKE

Countywide Problem Identification
Emery County is the site of at least two active faults. Both are located on the western border of the county in Joe's valley and are named the Joe's Valley Fault. Joe's Valley appears to be highly vulnerable to such an event and an earthquake-induced failure of the dam would put Orangeville and Castle Dale in jeopardy. An updated analysis is needed to evaluate earthquake faults and subsequent risk of damage to buildings and infrastructure in the county.

Goal 1: Priority Medium

Objective 1 - Have a study done to determine seismic resistance of structures within the county I.E. Elementary school, high schools, public buildings, and highways.

Action: Structural and non-structural earthquake hazard assessment.
Time Frame: 3 to 4 years
Funding: Unknown
Estimated Cost: Unknown
Staff: Unknown
Background: Contact DESHS earthquake program specialist. Several seismographic tests have been done within the county most likely for oil.

Countywide Problem Identification
Residents uneducated about earthquakes.

Goal 2: Priority Medium

Objective 1 - Public Awareness

Action: Conduct pubic awareness campaign. Enhance earthquake instructions in school.

Time Frame: Ongoing
Funding: Federal and state grants, local sources.
Estimated Cost: Minimal
Staff: LEPC, volunteers and school administration.
Background: Contact DESHS earthquake program specialist.

Countywide Problem Identification
Requiring building code(s) and zoning ordinance enforcement

Goal 3- Priority MEDIUM

Objective 1 – Verify Building Codes and Zoning Ordinances are updated

Action: Check with Planning and Zoning on building codes.
Time Frame: Ongoing
Funding: Local sources.
Estimated Cost: Minimal
Staff: County, Cities and Town Building Officials and Planning and Zoning Dept.
Background: Ensure building codes are being implemented.

FLOOD

Countywide Problem Identification
There is not enough current flood information on flood areas in Emery County to identify the problem at this time.

Goal 1: Priority Medium

Objective 1 - Identify additional flood prone areas in county

Action: Evaluate need for additional County flood mapping of potential flood hazard areas.
Time Frame: Unknown
Funding: FEMA
Estimated Cost: Undetermined
Staff: State and FEMA personnel.
Background: Contact DESHS flood map specialist.

Action: Participate in the FEMA Flood Map Modernization Program
Time Frame: Ongoing
Funding: FEMA
Estimated Cost: Some cost share may be required.
Staff: County Emergency Management and State Floodplain Office
Background: Emery County has areas that should be reevaluated for flood hazards. Town of Cleveland and City of Green River have indicated their current flood map does not reflect the flood hazard and boundaries are inconsistent.

Countywide Problem Identification
Unstable canals are a flood threat

Objective 1 - To reduce the threat of flood from canal failures in the county

Action: Technical analysis on the irrigation canals
Time Frame: Ongoing
Funding: Unknown
Estimated Cost: Unknown.
Staff: Private, County Engineer

Background: Private canals and irrigation systems have proven to breach or fail flood.

Countywide Problem Identification
Participation in the NFIP allows citizens to mitigate flood damage through purchasing of flood insurance. Residents are not aware flood insurance is available. Communities are not aware of flood damage prevention ordinance that are in place for development in floodplains.

Goal – Priority - MEDIUM

Objective 1 - Promote purchase of flood insurance
Action: Obtain outreach materials on flood insurance
Time Frame: Immediately
Funding: None
Estimated Cost: Printing of FEMA documents
Staff: County and City Floodplain Administrators, County Emergency Management
Background: Flood insurance is an effective mitigation measure.

Objective 2 - Educate local Floodplain Administrators on floodplain compliance.
Action: Make training available on flood compliance and NFIP
Time Frame: 1 year
Funding: None
Estimated Cost: None
Staff: County and City Floodplain Administrators, Building Officials, Planning and Zone, State Floodplain Manager
Background: Contact State Floodplain Manager and arrange training.

SEVERE WEATHER

Countywide Problem Identification
Winter storms, summer thunderstorms, flash floods hail, and high winds over eastern Utah have a dramatic effect on regional commerce, transportation, and daily activity and are a major forecast challenge for local meteorologists.

Goal 1 – Priority HIGH

Objective 1 - protect County from adverse affects of severe weather

Action 1: County participates in the Storm Ready program.
Time Frame: 2 Year
Funding: State and Federal
Estimated Cost: Unknown
Staff: City and County Emergency Management
Background: Set up within the county emergency management and encourage all cities to participate, all requirements of the National Weather Service Storm Ready program.

Action 2: Encourage avalanche preparedness for county backcountry users.
Time Frame: 1 Year
Funding: Minimal
Estimated Cost: Minimal
Staff: County Emergency Management State Hazard Mitigation Team members, Utah Avalanche Forecast Center.
Jurisdictions: Countywide
Background: Avalanches and avalanche preparedness is not often considered when discussing mitigation on the county or city level, yet several people die each year in Utah's backcountry. While the avalanche terrain is mainly on US Forest Service land the

search and rescue for the lost individual in more often than not coordinated by emergency managers with search parties comprised of county and city staff. Introductory avalanche awareness training could lessen the costs to Emery County and the cities within the county. Most avalanche victims die in avalanches started by themselves or someone in there party. Thus, education can limit the number of avalanche related searches each year.

Action 3: Assess EOC's to ensure they are grounded lightning, to include buildings with towers
Time frame: 2-3 years
Funding: Federal Grants
Estimated Cost: Unknown
Staff: County Emergency Management
Jurisdictions: Countywide
Background: Alternate EOC(s), Sheriff's Dispatch, Command Vehicle(s)and associated equipment need to be protected from sever weather events including lightning.

LANDSLIDE
Countywide Problem Identification
There is a potential risk to structures located in areas identified Federal and state agencies and depicted in GIS as landslide risk areas.

Goal 1: Priority Low

Objective 1- Minimize loss of life, damage to property and disruption in residents, commerce and government services caused by landslides through structural measures.

Action 1: Build retaining fences and momentum absorbers along highways prone to landslide and rockfalls, Highway 29, Highway 10.
Time Frame: 5 years
Funding: Federal, State, Local
Estimated Cost: $1,000,000
Staff: UDOT, County Road Dept.
Background: Steep slopes and freeze thaw conditions create hazardous conditions

Action 2: Dislodge large rocks along highways
Time Frame: Immediate
Funding: Federal, State, Local
Estimated Cost: $100,000
Staff: UDOT, County Road Dept.
Background: Steep slopes and freeze thaw conditions create hazardous conditions

Action 3: Build retaining walls on residents identified at risk
Time Frame: 5 years
Funding: Individual
Estimated Cost: Variable
Staff: Unknown
Background: Protect homes in areas at risk.

Action 4: Develop pathways to capture falling rocks adjacent to residences
Time Frame: 5 years
Funding: Federal, State, and Local
Estimated Cost: $100,000
Staff: Cities, towns, and county
Background: Identify areas in residential areas that could accommodate pathways

PROBLEM SOILS

Countywide Problem Identification
Problem soils are a risk to property and life due to its volatility

Goal 1: Priority Low

Objective 1 - Protect roadways

Action 1: Increase width of slope adjacent to roadways
Time Frame: Extended
Funding: Federal, State, and Local
Estimated Cost: Unknown
Staff: State, county, and city
Background: Allows for buffer zone

Action 2: Educate homeowners about problem soil risk
Time Frame: 2 years
Funding: Local
Estimated Cost: $3,000
Staff: Local
Background: County Building Official should have information available to citizens

Action 3: Identify, monitor and control water on alkali soils
Time Frame: Ongoing
Funding: Local
Estimated Cost: Unknown
Staff: Local
Background: Identifying areas of concern will help with planning.

INFESTATION

Countywide Problem Identification
Infestation of noxious insects and can impact the health, safety and welfare of County and its residents.

Goal 1: Priority Low

Objective 1 - Control insects

Action 1: Insecticide spray
Time Frame: Ongoing
Funding: Local, State and Federal
Estimated Cost: Unknown
Staff: Local and Federal
Background: Insect abatement districts and federal insect control should be coordinated

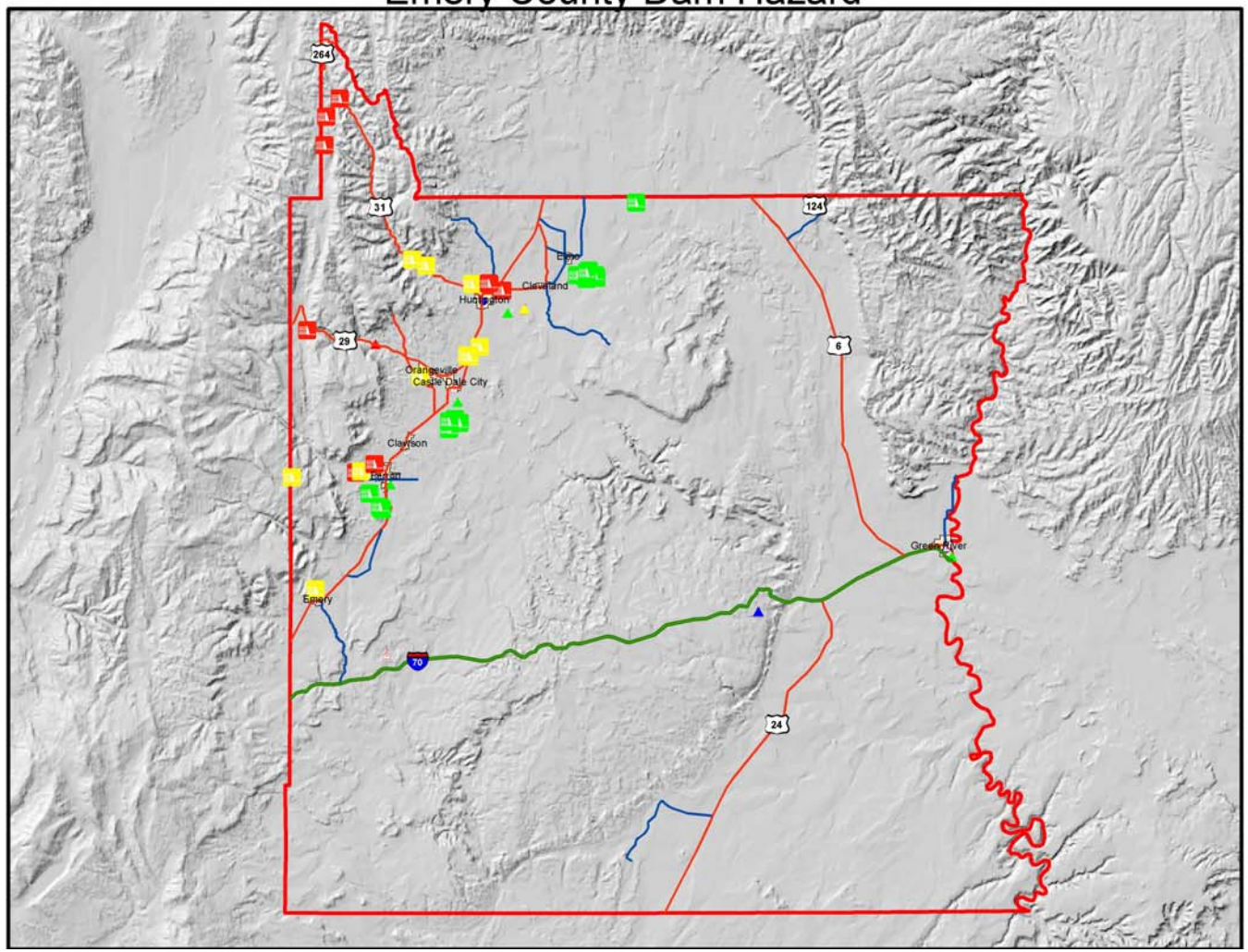
Action 2: Remove dead and diseased trees
Time Frame: Extended
Funding: Private
Estimated Cost: Trees will be harvested by commercial enterprise.
Staff: Private
Background: This could be a part of the fire management program and limited spread of infestation

H. Mapping

All of the following maps have been created for the purpose of Pre-Disaster Mitigation using the best available data at the time of the creation of this plan. WFRC and its staff members cannot accept responsibility for any errors, omissions, or positional accuracy; therefore no warranties are made respecting their accuracy.

Map 8.1.1 Dam Hazard
Map 8.3.1 Landslide Hazard
Map 8.1 Earthquake Hazard
Map 8.2 Problem Soils

Emery County Dam Hazard



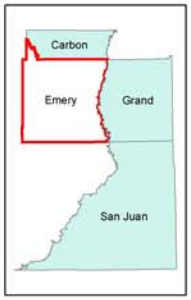
DAM HAZARD

- HIGH - Possible loss of life
- MODERATE - Significant property loss
- LOW - Insignificant property loss
- Potable Water Facility
- Oil Facility
- Electric Power Facility
- Schools
- Waste Water Facility
- Fire Stations
- Police Stations

N
W E
S

0 5 10 20
Miles

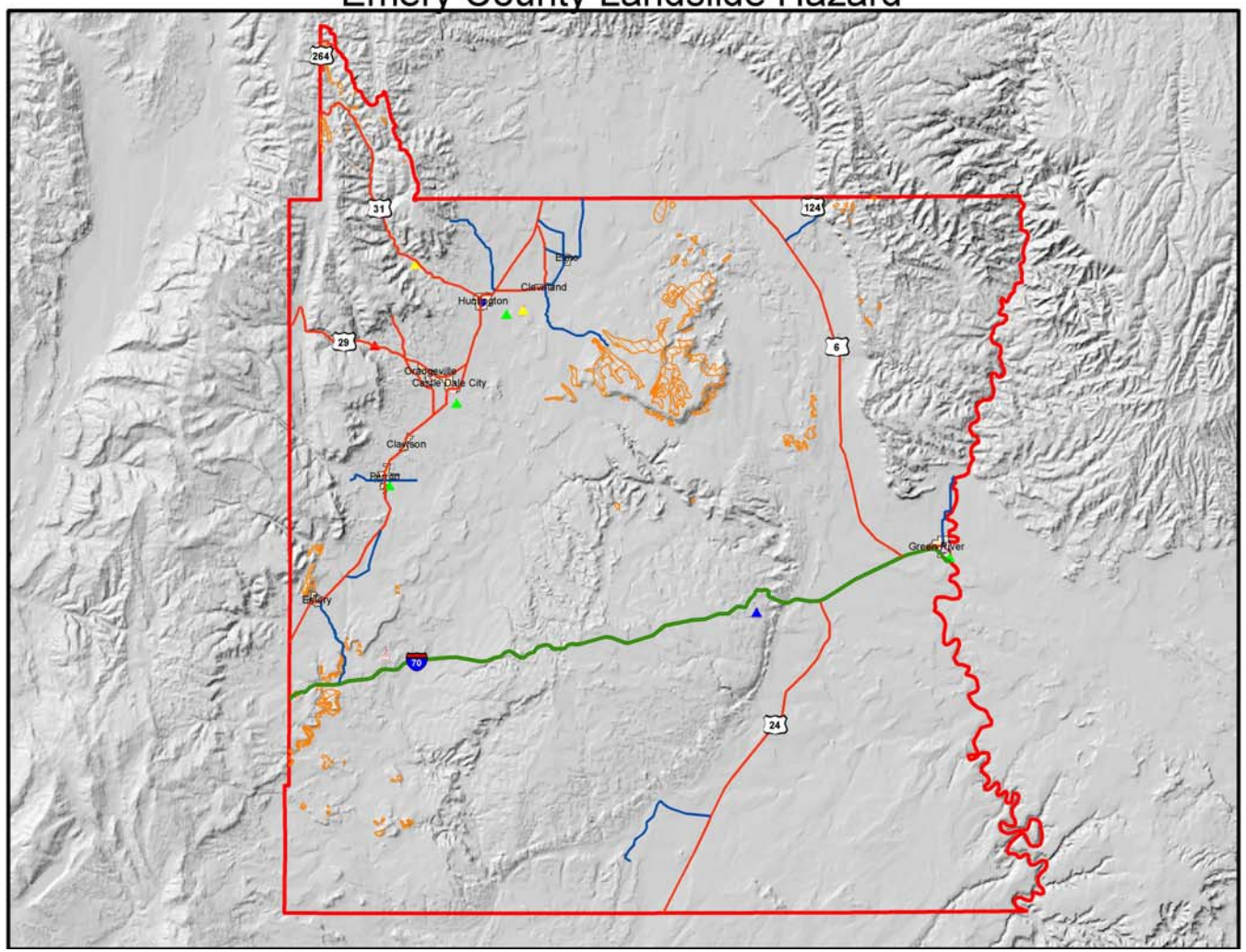
Southeastern Association of Local Governments



Data Source: Infromation provided by DESHA, and Utah AGRC

Map produced by the Wasatch Front Regional Council and is "as is". The WFRC cannot accept responsibility for any errors, omissions, or positional accuracy, therefore there are no warranties which accompany this product.

Emery County Landslide Hazard

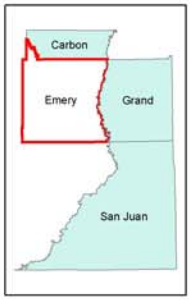


Landslides
Potable Water Facility
Oil Facility
Electric Power Facility
Schools
Waste Water Facility
Fire Stations
Police Stations

N
W E
S

0 5 10 20
Miles

Southeastern Association of Local Governments



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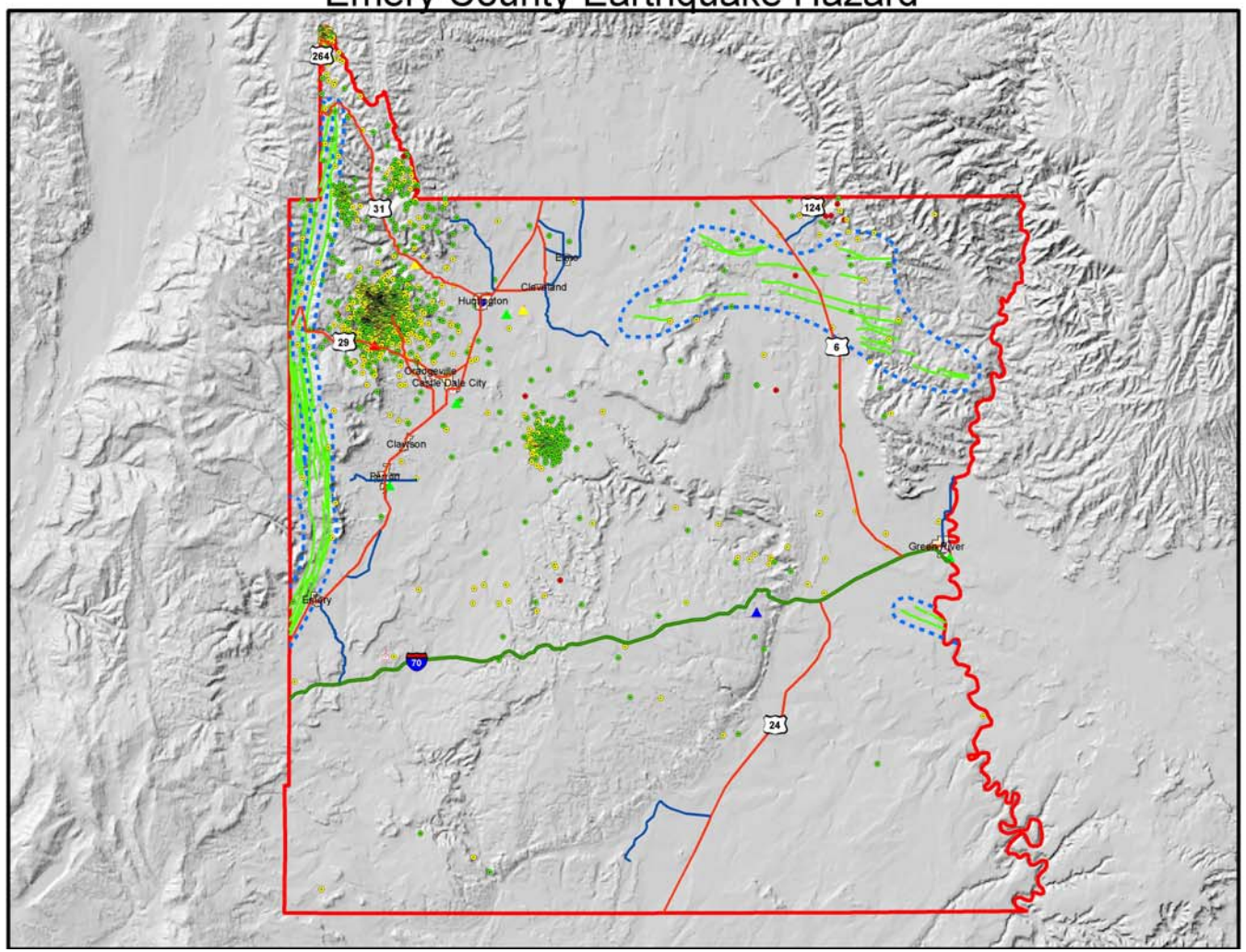
Emery County Earthquake Hazard



Faults
Fault Zones

Epicenters
- 1 - 2
- 2 - 3
- 3 - 4

Potable Water Facility
Oil Facility
Electric Power Facility
Schools
Waste Water Facility
Fire Stations
Police Stations

N
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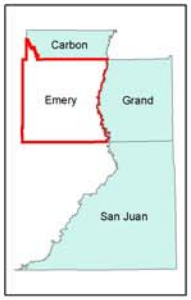
S

0 5 10 20
Miles

Southeastern Association of Local Governments



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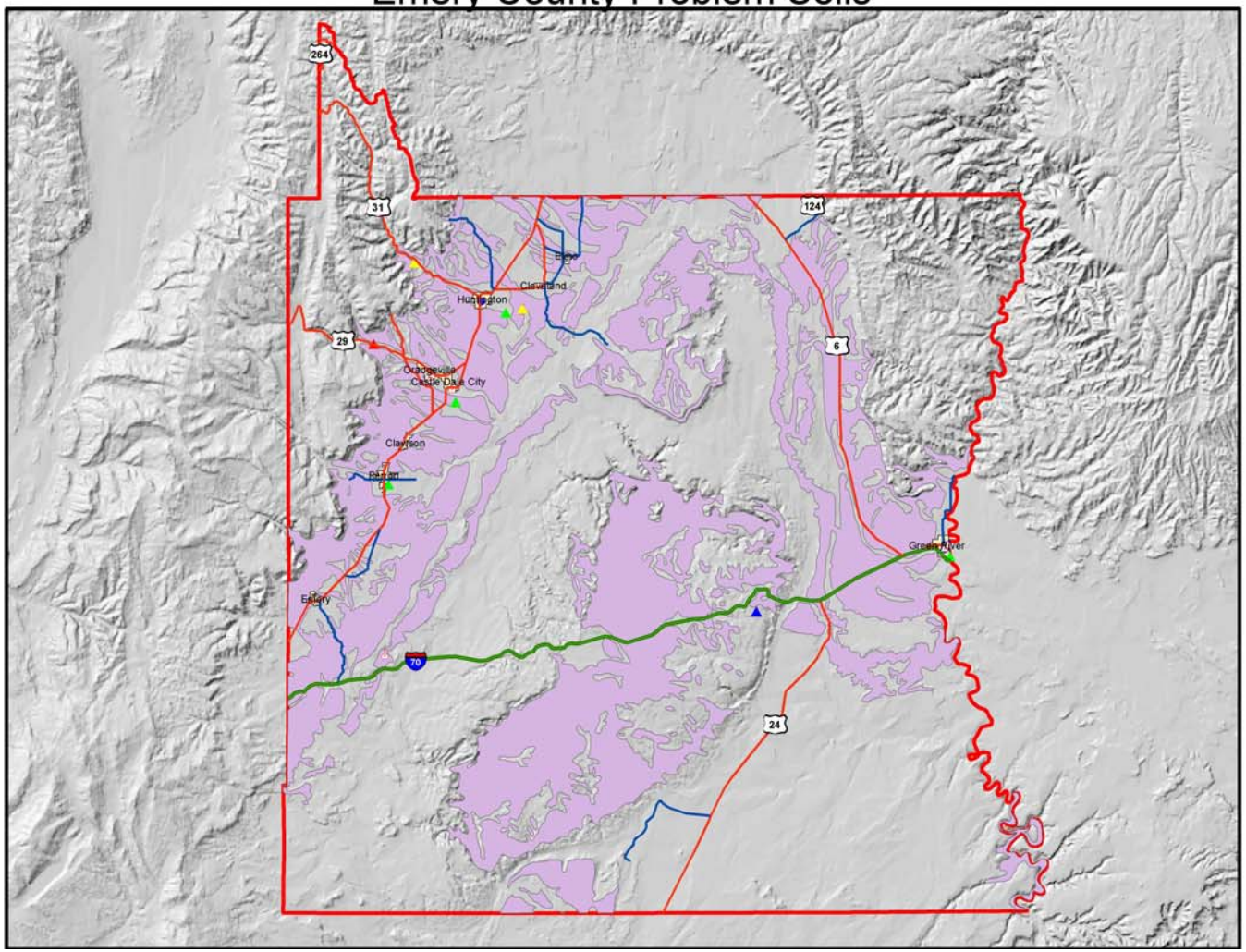
Emery County Problem Soils

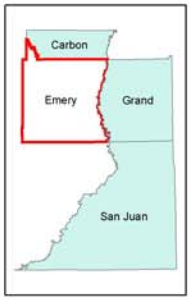


- Expansive Soil or Rock
- Potable Water Facility
- Oil Facility
- Electric Power Facility
- Schools
- Waste Water Facility
- Fire Stations
- Police Stations

N
W E
S

0 5 10 20
Miles

Southeastern Association of Local Governments



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Part 9. Grand County

Grand County is made up of two jurisdictions: Castle Valley and Moab City. The county is located in the southeastern portion of the state on the Utah Colorado border.

A. Demographics and Population Growth

The following information involving Population Estimates, Average Annual Rate of Change, and Population and Development Trends is important in understanding the impacts that a natural hazard would have on a local community. Population numbers also identify the constancy of a community by determining the degree of change a community (Table 9-1).

Table 9-1 Grand County Population

	Grand County	Castle Valley	Moab City	Balance of Grand County	Southeast Region
1980 Census Population	8,241				54,124
1990 Census Population	6,620	211	3,971	2,438	49,801
2000 Census Population	8,485	349	4,779	3,357	54,180
2005 Population Projections	8,596				54,559
2010 Population Projections	8,969				57,699
2015 Population Projections	9,638				62,754
2020 Population Projections	10,102				66,489
2030 Population Projections	10,122				67,867
1990-2000 AARC	2.5	5.2	1.9	3.3	
2000-2030 AARC	0.59%				0.75%
1990-2000 Percent Change	28.2%				
Rank by 2000 Population	20				

Rank by Percent Change	12				
Rank by AARC	12				
Source: Bureau of the Census, 2002 Baseline Projections, and Utah Population Estimates Committee. Governor's Office of Planning and Budget. 1980 and 1990 populations are April 1 U.S. Census modified age, race and sex (MARS) populations; 2000 populations, household sizes and households are April 1 U.S. Census summary file 1 (SF1) populations; all others are July 1 populations. Note AARC is average annual rate of change.					

B. Economy

Presently, Grand County is working to diversify its economy by targeting light manufacturing, tourism and recreation, the fine arts, educational programs, television and motion picture production, agricultural, and through the development of natural resources. Grand County's economy is slowly expanding and moving forward. The unemployment rate for Grand County as of October 2002 was 6.4 percent, a 0.6-point drop from the 7 percent in October 2001. Non-farm jobs, construction, and manufacturing have all had a slight employment gain. The economy here is resilient and will continue to grow as the nation's economy improves (Grand County Trends). The 2000 estimated average house value is $123,751 (Annual Statistical).

C. Transportation and Commuting Patterns

The principle transportation routes through Grand County are Interstate 70 and U.S. Highway 191. The principle east-west corridor through Grand County is Interstate 70 (I-70). I-70 travels through the center of the county to the Colorado border. U.S. Highway 191 is the north-south corridor heading south from Crescent Junction off I-70, through the town of Moab, into San Juan County (Traffic Volume Map).

D. Land Use and Development Trends

Grand County uranium mining began in the early 1950's and as a result, the population jumped to nearly 10,000 in three years. Potash and salt mining, as well as milling operations were another source of economic prosperity in Grand County. Since the 1990's the local economy has been driven primarily by tourism. Over 1 million visitors enjoy mountain biking, river rafting, rock climbing, hiking, and four wheeling each year (Grand County History). Most land is owned and maintained by federal and state agencies, including the Bureau of Land Management (BLM), the Forest Service (FS), the National Park Service (NPS), and the Utah Divisions Of Forestry, Fire and State Lands (FFSL).

Moab City is the largest city within the county and offers a variety of residential and commercial real estate. There are an estimated 3,712 family housing units within Moab and Spanish Valley combined. These housing units include single family, mobile homes, and apartment homes. Because of the quiet streets and larger sized lots subdivisions and housing complexes in the area are very attractive for area newcomers. The median value of a home is $120,000.

E. Risk Assessment

The risk assessment process revealed the following risks: Drought, Flood, Wildfire, Severe Weather, Landslide, Earthquake, and Problem Soil. Risk assessment maps were completed for the mapped hazards and can be viewed at the end of this section. Refer to Part 6 for an explanation of the risk assessment process. According to GIS data there are a total of 17 identified critical facilities within Grand County (Appendix C).

Grand County and each jurisdiction contributed to the risk assessment analyses performed for the county when located within an identified hazard boundary (see Section E). Drought, Earthquake, and Severe Weather are regional hazards and have been profiled as such (Part 4 Regional Data).

1. Flood

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
		Limited	10-25%
	X	Critical	25-50%
		Catastrophic	More than 50%
Probability	X	Highly Likely	
		Likely	
		Possible	
		Unlikely	
Location	See map in Section H, mainly near the major rivers of the Colorado and Green and their respective tributaries.		
Seasonal Pattern or Conditions	Spring, Cloudburst Storms and Heavy Snowfall Runoff.		
Duration	Flooding can last anywhere from hours to days and even months.		
Analysis Used	Review of FIS, FIRM, Army Corp of Engineers Flood Study, Hazard Analysis Plans, GIS data, Moab City Project Impact Application, Moab Hazard Mitigation Plan, and have worked with local residents of the community.		

Description of Location and Extent

The local planning team members including the county GIS department were unable to map flood prone areas within the county and complete a risk assessment due to the lack of digitized data. The Army Corps of Engineers compiled a rudimentary Flood Hazard Identification Study in 2003. This study can be found in Appendix E. The Army Corps' study identified the smaller unmapped tributaries of Castle Creek and its tributaries as threats in Castle Valley.

The City of Moab recorded 29 of 36 total flood events. Because of its location with streams and rivers, Moab has a very high flood threat. Moab City is the county seat and the largest community in the county and has been designated as a Project Impact Community. As a result, a Moab City Storm Water Management Plan was created and flood control issues were identified and put into place for Pack Creek, Mill Creek, and the Colorado River. Over half of the community is in a floodplain. Moab is subject to flash flooding mainly from the frequent thunderstorms and cloudbursts that occur in the steep slickrock canyons. Local roads, infrastructure, and residences are all subject to repeat flooding at Walker Canyon, Stewart Canyon, the Kelling Property, and Williams Way.

Vulnerability Assessment

Mill Creek floodplain flooding events were calculated for 13, 67, 125, and 370 -year events relaying the number of structures lost and approximate dollar losses for each flood event (Table 9-4).

Table 9-4 Mill Creek Floodplain Damage Estimates

Year	Approximate Dollar Loss	Number of Structures (residential and commercial)
370	71,709	848
125	68,577	772
67	50,218	486
13	22,396	86

Dam Failure Flooding

Ken's Lake is actually located in San Juan County, however the risk is region-wide. Ken's Lake Reservoir is considered to have a high hazard threat. The dam was built in 1981 and is owned by the Grand County Water Conservancy District. The reservoir storage at spillway crest is 2,820 acre-feet and the reservoir storage at dam crest is 3,360 acre-feet. The spillway type is open channel and the maximum dam breach flow is 64,000 cfs with a 3 square mile drainage basin area. The first downstream town is Moab, 6 miles away.

2. Wildland Fire

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
		Limited	10-25%
	X	Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
	X	Likely	
		Possible	
		Unlikely	
Location	URWIN zones near the foothills and in forested areas. See map in Section H		
Seasonal Pattern or Conditions	Summer months. Areas affected by drought and/or heavily overgrown and dry brush and debris. Lightning and human triggers.		
Duration	Wildfires typically last days but can last months, depending on climate and fuel load as well as resources (financial, manpower) to extinguish the fire.		
Analysis Used	Review of plans and data provided by US Forest Service, National Climate Center, FEMA, AGRC, County Hazard Analysis Plans, and DESHS.		

Description of Location and Extent

The Division of Emergency Services assigned five hazard categories to the wildfire risk data provided in the statewide fire risk assessment-- Extreme, High, Medium, Low, and Very Low. These ratings cover all of Grand County and are based on the type and density of vegetation in each area. Factors influencing wildland fire behavior such as weather conditions, wind speed and direction are not considered in this risk assessment. Refer to Table 9-9 for the recorded history of wildfires in the county.

Vulnerability Assessment

Loss estimates were completed by identifying the wildland fire areas of extreme, high, and moderate within the county then overlaying the municipalities in a GIS database that identifies the vulnerable areas. The following table includes the population and number of commercial, and residential structures inside extreme, high and moderate wildfire risk areas within the county (Table 9-5).

Table 9-5 Structures and Population in Wildfire Area

Use Type	Extreme Risk	High Risk	Moderate Risk
Commercial Units	0	36	20
Residential Units	0	417	242
Population	0	828	368

Potential Wildfire Loss Estimates

Table 9-6 details the annual sales of the businesses inside each wildfire risk area, and the assessed value of residential property in each wildfire risk area. Residential loss estimates do not include contents; including the value of contents would increase the values listed by 50%. No businesses are located in Grand County in Extreme wildfire risk areas. All businesses located in High and Medium Wildfire Risk areas except one are in the City of Moab or Castle Valley. The Thompson's Springs Fire Department is the only Critical Facility in Grand County located in a wildfire risk area.

Table 9-6 Inventory of Properties Located in Wildfire Risk Areas in Grand County

Businesses Number/Annual Sales	**Residential Units** Number/Replacement Cost	**Population**
56 / $42,300,000	659 / $81,551,909	1,196

Wildfire Risk within Municipal Boundaries

Table 9-6 lists the number of acres in each wildfire risk area contained within the municipal boundaries of the following cities in Grand County. Table 9-8 identifies the infrastructure found within wildfire areas.

Table 9-7 Wildfire Risk Area

City Name	Acres of Extreme	Acres of High	Acres of Moderate
Moab	0	635	117
Castle Valley	0	1,253	2,888
Green River	0	0	0

Table 9-8 Infrastructure in Wildfire Area

Item	Length (Miles)	Replacement Cost
Local Roads	116.09	$232,176,800
State Highways	41.38	$99,877,629
US Highways	0.00	$0
US Interstates	29.41	$105,875,280
Power Lines	124.03	$5,988,168
Gas Lines	26.33	$6,355,799

Table 9-9 Wildfire History

Date	Fire Name	Cause	Size
6/19/84	Agate Oilfield	Lightning	300 - 999 Acres
6/9/85	East Cisco	Equipment	300 - 999 Acres
6/25/85	Cottonwood	Lightning	300 - 999 Acres
7/4/85	Sager 2	Equipment	300 - 999 Acres
7/7/85	Little Hole	Lightning	300 - 999 Acres
8/14/85	Border R733	Lightning	300 - 999 Acres
8/16/85	Mile Post 222	Lightning	300 - 999 Acres
8/31/85	Brewster 1	Incendiary	300 - 999 Acres
6/8/86	Westwater 2	Debris Burn	300 - 999 Acres
6/19/86	East	Railroad	300 - 999 Acres
7/6/86	Harley	Lightning	300 - 999 Acres
7/12/86	Westwater Comp	Lightning	1000 - 4999 Acres
8/5/86	Bitter Creek	Lightning	300 - 999 Acres
7/1/89	Diamond Peak	Lightning	> 5000 Acres
7/8/89	Ryan Creek	Lightning	1000 - 4999 Acres
7/10/93	Whipsaw Flat	Lightning	300 - 999 Acres
8/13/93	Westwater 2	Lightning	300 - 999 Acres
6/9/94	Thompson	Equipment	1000 - 4999 Acres
7/23/94	Mm 213	Miscellaneous	300 - 999 Acres
8/30/94	Westwater 3	Lightning	1000 - 4999 Acres
6/19/95	Valley City 2	Lightning	1000 - 4999 Acres
6/24/95	Valley City 3	Miscellaneous	300 - 999 Acres
8/16/96	One Eye	Lightning	300 - 999 Acres
7/1/99	Little Hole	Lightning	1000 - 4999 Acres
5/28/00	Fisher	Lightning	300 - 999 Acres

3. Landslide

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
		Limited	10-25%
	X	Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
		Likely	
	X	Possible	
		Unlikely	
Location	See map in Section H. Generally occur in canyon mouths and foothill areas. Manti-La Sal National Forest, near foothills on steep slopes, cliff faces, canyon walls.		
Seasonal Pattern or Conditions	Spring and Summer usually caused by the stress release of over-weighted soils and or loosening of rock and debris.		
Duration	Landslides generally last hours or days, but some can last weeks.		
Analysis Used	Information and maps provided by UGS, DESHS, AGRC.		

Description of Location and Extent

The map "Grand County Landslide Hazard" shows the locations of high-risk landslide areas by identifying historical landslide locations. The main historical landslides in Grand County occurred in the Southeastern portion of the Manti-La Sal National Forest, just east of Green River. Generally, landslides are located in well-defined, localized areas. The identified historical areas will most likely be the location of future landslides.

Vulnerability Assessment

The hazard analysis indicates that there are no business or critical facilities in Grand County that are located within the high landslide risk area. There are residential units as well as general infrastructure within the risk area (Tables 9-10, 9-11).

Table 9-10 Inventory of Properties Located in Landslide Risk Areas in Grand County

Businesses	Residential Units	Population
Number\Annual Sales	Number\Replacement Cost	
0 /$0	97 \ $12,003,847	127

Table 9-11 Infrastructure in Landslide

Item	Length (Miles)	Replacement Cost
Local Roads	5.77	$11,540,000
State Highways	0.00	$0
US Highways	0.00	$0
US Interstates	0.00	$0
Power Lines	2.56	$123,597
Gas Lines	0.00	$0

4. Problem Soil

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
		Limited	10-25%
	X	Critical	25-50%
		Catastrophic	More than 50%
Probability	X	Highly Likely	
		Likely	
		Possible	
		Unlikely	
Location	See map in Section H. Central and southern portions of the county.		
Seasonal Pattern or Conditions	Spring and Summer		
Duration	Constant problem		
Analysis Used	Review of information and maps provided by County soil classification books, Soil Conservation Service, local input, UGS, DESHS, and AGRC.		

Description of Location and Extent

In 1991 the Soil Conservation Service (SCS) studied the Canyonlands area just south of the Grand County border. The soils within the study area range from well-drained silty soils to impervious rock. Based upon the soil makeup, permeability in the bluffs of the southeastern portion of the county is considered by the SCS to be generally moderate, meaning they have medium to rapid runoff conditions. The soils according to SCS in the Moab City developed region have moderate to rapid permeability which means they have slow to medium runoff. Expansive soil and rock affect the central and southern portions of the county and minor amounts of silica dune are found in the mid-southern portion.

Using the problem soils and major roadways map from DESHS developed for the State of Utah and Census 2000 block data, the two maps were overlaid to indicate where households and roadways exist in relation to problem soil areas. The results from the analysis are presented in Table 9-12 below (no households were identified in problem soil areas). Roadway replacement was calculated assuming a cost of $2 Million per mile. The map "Grand County Problem Soils" shows the areas of Problem Soils within Grand County.

Table 9-12 Roadways in Grand County located on Problem Soil Areas

Roadway	Miles	Estimated Replacement Cost
I-70	42.53	$148,858,010
West Main St.	0.41	$826,729
East Main St.	0.53	$1,065,863
Main St.	0.19	$380,063
South Main St.	0.51	$1,029,283
North Main St.	0.32	$634,556
State Route 10	40.91	$81,814,581
State Route 155	5.64	$11,278,533
State Route 24	4.78	$9,560,011
State Route 29	4.87	$9,737,116
State Route 31	4.50	$8,998,304
State Route 57	9.74	$19,474,253
U.S. Highway 6	35.69	$71,389,921

F. Hazard History

Identifying past hazard events is key in predicting where future events are likely to occur. The following available relevant information such as date, location, area impacted, and damage costs are identified in the table below (Table 9-14). Due to the frequency and geographic extent of problem soil, and some severe weather events past events have not been recorded and are therefore not identified in the table below.

Table 9-14 Hazard Histories

Hazard	Date	Location	Critical Facility/ Area Impacted	Comments
Cloudburst storm	August 28, 1939	Moab City	Mill Creek	$5,000 in damage to homes, businesses and streets, serious damage to the powerhouse
Flood	August 31, 1939	Town of Cisco	Diamond Creek	One death
Flash Flood	July 23, 1953	Moab City		Thousands of dollars of damage to a movie production set at Fisher Towers
Flash Flood	August 6, 1957	Moab City	Mill Creek	Several thousand dollars damage to property and crops, and culinary water lines across Mill Creek
Flash Flood	August 29-30, 1957	Moab City	Thompson	Heavy rains caused flooding along streets and highways, destroying several homes
Tornado	May 4,1961	Grand County		F1 tornado
Flash Flood	August 25-26, 1961			Thousands of dollars of damage was recorded to motels and homes. Highway 160 was blocked
Flood	June 29-30, 1962	Moab City	Walker Subdivision	Moab city park flooded
Flood	August 8, 1963	Moab City	Mill Creek and Pack Creek	Destroyed sewer mains. Streets and roads were damaged and several hundred acres of land were covered with silt
Flood	October 15, 1965	Moab City	Mill Creek and Pack Creek	$1,500 damage to culverts, roads, and bridges
Flood	June 5, 1967	Moab City	Northern Moab,	Worst flood in 20

			US 160, Main Street.	years. Destroyed homes, businesses, establishments, apartments, and streets. Thousands of dollars of damage.
Hail	August 14, 1968	Grand County		1.75 inches
Flood	August 17, 1968	Moab City		Destroyed homes, businesses, and roads; covered in mud and water. Damage totaled about $50,000
Thunderstorm/ High winds	April 06, 1969			
Tornado	June 10, 1970	Grand County		F2 Tornado
Avalanche	Winter 1970	Grand County	Miner's Basin	1 building destroyed
Avalanche	1970	Grand County		2 deaths
Thunderstorm/ High winds	August 30, 1971	Grand County		
Earthquake	March 14, 1974	Grand County	Cisco	3.2 Richter Magnitude
Hail	June 10, 1976	Grand County		1.75 inches
Hail	August 30, 1986	Grand County		1.00 inches
Avalanche	February 1991	Grand County	Talking Mountain	4 deaths 6 buried
Funnel Cloud	October 07, 1993	Moab City		
Lightning	August 16, 1995	Moab City		1 death, 1 injury
Lightning	September 29, 1995	Moab City		1 injury
Lightning	August 17, 1996	Moab City		1 death
Flash Flood	September 06, 1997	Moab City		$175,000 property damage
Hail	September 20, 1997	Crescent Junction		1.75 inches
Winter Storm	December 07, 1997	Grand County		1 death, 20 injuries, $200,000 property damage
Heavy Rain	September 12, 1998	Moab City		
Winter Storm	December 19, 1998	Grand County		10 injuries, $100,000 property damage
Extreme Cold	December 21, 1998	Grand County		$20,000 property damage
High Winds	April 09, 1999	Grand County		60 kts. $2,000 property damage
Lightning	May 29, 1999	Cisco		1 death
Wildfire	June 20-21, 1999	Westwater		
Flash Flood	July 08, 1999	Moab City		
Lightning	July 14, 1999	Crescent Junction		
Flash Flood	July 14, 1999	Moab City		$60,000 property damage
Heavy Rain	July 27, 1999	Moab City		$10,000 property

				damage
Flash Flood	July 30, 1999	Thompson		$2,000 property damage
Flash Flood	August 11, 1999	Moab City		
Thunderstorm/ High Winds	August 30, 1999	Canyonlands		50 kts.
Tornado	April 18, 2000	Grand County	Moab City	F0 Tornado, $1,000 property damage
High Winds	April 18, 2000	Grand County		60 kts. $20,000 property damage
Thunderstorm/ High Winds	May 24, 2000	Moab City		50 kts.
Thunderstorm/ High Winds	May 25, 2000	Canyonlands		50 kts.
Wildfire	July 04, 2000	Cisco		
Flood	July 09, 2000	Moab City		
Lightning	July 09, 2000	Moab City		$100,000 property damage
Wildfire	July 15, 2000	Cisco		
Lightning	July 22, 2000	Moab City		$2,000 property damage
Wildfire	July 24, 2000	Westwater		
Wildfire	August 15, 2000	Westwater		
Thunderstorm/ High Winds	August 20, 2000	Canyonlands		50 kts.
Tornado	September 08, 2000	Grand County		F0? Tornado
Hail	September 21, 2000	Cisco		1.00 inches, $10,000 property damage
Heavy Snow	December 24, 2000	Grand County		
High Winds	April 20, 2001	Grand County		50 kts. $10,000 property damage
Flood	July 08, 2001	Moab City		
Flood	July 09, 2001	Moab, Canyonlands		
Flash Flood	July 10, 2001	Moab City		
Flood	August 13, 2001	Moab City		
Winter Storm	January 28, 2002	Grand County		
Drought	May 01, 2002	Grand County		
Thunderstorm/ High Winds	May 15, 2002	Cisco		67 kts.
Drought	June 01, 2002	Grand County		
Wildfire	June 20, 2002	Thompson		
Wildfire	June 22, 2002	Thompson		
Wildfire	June 27, 2002	Thompson		

G. Mitigation Goals, Objectives, Actions

Mitigation Strategies Workbook
Grand County

Note: Countywide in this document refers to a mitigation strategy benefiting the cities, towns and communities of: Thompson Springs, Cisco, Castle Valley and Moab City.

Grand County and Moab City have certified Emergency Service Personnel including, City Police, Grand County Sheriffs, EMT, Building Inspectors, and the Moab Valley Fire Department.

The following documents are the documents used for mitigation and action plans.

- The Grand County Storm Drainage Master Plan as amended to date.
- The Grand County Land Use Code, specifically Articles 4, 5, & 6, as amended to date.
- Moab City Code Chapter 15.40, Flood Damage Reduction as amended to date.
- The FIRM Flood Map for Moab City Panel 2 of 2.
- Grand County Emergency Operations Plan, as amended to date
- Moab Valley Wildfire Mitigation Plan as amended to date.
- International Building Codes as adopted.

FLOODING

Countywide Problem Identification
The rapid development of the county has caused a need to re-evaluate the system and establish a plan and level of service to manage stormwater. Development also directly impacts the historical drainage ways with culverts roads and structures.

Goal 1 – Priority HIGH

Objective 1.1 – Continue to support and update Storm Water Management Plan.

Action: Review and revise Storm Water Management Plan as development warrants.
Time Frame: Ongoing
Funding: County and impact fees
Estimated Cost: Depends on extent of identified projects within Plan.
Staff: County, Private Contractors
Background: The Storm Water Management Plan as protected the County from flood losses. This Plan also contains identified storm water basins and other structural control projects.

Problem Identification: Flood occurs primarily from spring snowmelt in the higher elevations and summer flash flooding. Identifying and then controlling flooding will assist in responding to flood events. Protection of life and property before, during, and after a flooding event is essential.

Goal 1 – Priority High

Objective 1.1 Encourage 100% participation in the National Flood Insurance Program (NFIP).

Action: Assist Unincorporated Grand County in joining NFIP
Time Frame: 1 year
Funding: None required
Estimated Cost: None
Staff: County Emergency Management, County Engineer, And State Floodplain Manager

Background: Special Flood Hazard Areas have been identified by FEMA in the Unincorporated County. The County has chosen not to participate in the NFIP. Flood insurance is not available in the Unincorporated County.

Objective 1.2 Promote flood insurance throughout the County

Action: Create outreach document promoting flood insurance and include in local newspaper(s), libraries, and other public buildings.

Time Frame: 1 year
Funding: Minimal
Estimated Cost: Unknown
Staff: County Engineer, State Floodplain Manager, and DES
Background: General public is usual not aware they can purchase flood insurance.

Objective 1.2 Reduce threat of unstable canals throughout the County. Identify County-wide canal systems

Action: Map and assess for structural integrity canal systems in the County

Time Frame: 3-5 years
Funding: Federal grants
Estimated Cost: Unknown
Staff: County Engineer, County Public Works, County Information and Technology, County Emergency Management
Background: Private and Public canals are used for transportation and dispersion of water as well as flood control.

Objective 1.3 Ensure EOC(s) is equipped to respond to flooding.

Action: Obtain communication equipment that will allow for timely response to flooding.

Time Frame: 1 year
Funding: Federal Grants
Estimated Cost: $30,000
Staff: County Sheriff, County Emergency Management
Background: An alternate EOC(s) also need adequate communication capabilities are essential between all response agencies within the County.

Objective 1.4 Support updating of flood hazard data

Action: Support and encourage participation in the NFIP Flood Map Mod Program.

Time Frame: Ongoing
Funding: Federal
Estimated Cost: Unknown
Staff: County Engineer, State Floodplain Manager
Background: Accurate flood maps assist the County in the administration of the NFIP and better reflects flood risk within the County. County must join the NFIP to be able to participate in Map Mod.

SEVERE WEATHER

Countywide Problem Identification
Snowstorms, summer thunderstorms, hail, and high winds over southeastern Utah have a dramatic effect on regional commerce, transportation, and daily activity and are a major forecast challenge for local meteorologists.

Goal 1 – Priority High

Objective 1.1 Protect County from adverse affects of severe weather

Action 1: County participates in the Storm Ready program.
Time Frame: 2 Year
Funding: State and Federal
Estimated Cost: Unknown
Staff: City and County Emergency Management
Background: Set up within the county emergency management and encourage all cities to participate, all requirements of the National Weather Service Storm Ready program.

Action 2: Encourage avalanche preparedness for county backcountry users in the northeastern portion of the County
Time Frame: 1 Year
Funding: Minimal
Estimated Cost: Minimal
Staff: County Emergency Management State Hazard Mitigation Team members, Utah Avalanche Forecast Center.
Background: Avalanches and avalanche preparedness is not often considered when discussing mitigation on the county or city level, yet several people die each year in Utah's backcountry. While the avalanche terrain is mainly on US Forest Service land the search and rescue for the lost individual in more often than not coordinated by emergency managers with search parties comprised of county and city staff. Introductory avalanche awareness training could lessen the costs to Grand County. Most avalanche victims die in avalanches started by themselves or someone in there party. Thus, education can limit the number of avalanche related searches each year.

Action 3: Assess EOC's to ensure they are grounded lightning, to include buildings with towers, etc.
Time Frame: 2-3 years
Funding: Federal Grants
Estimated Cost: Unknown
Staff: County Emergency Management
Background: EOC's and alternate EOC's**,** Sheriff's Dispatch, Command Vehicle(s)and associated equipment need to be protected from severe weather events including lightning.

SLOPE FAILURE (LANDSLIDE AND DEBRIS FLOW)

Countywide Problem Identification
There is a potential risk to structures located in areas identified by the SECAOG GIS as landslide risk areas.

Goal 1 – Priority Medium

Objective 1.1 Reduce potential landslide risk on commercial and residential structures in areas of known landslide potential.

Action: Assess the probability of landslides and identify specific structures at risk
Time Frame: Undetermined
Funding: Property owner
Estimated Cost: Unknown
Staff: Unknown
Background: Soil surveys and other engineering surveys are needed.

Problem Identification: Rockfall may impact structures within the County

Goal 1 – Priority Medium

Objective 1.1 Remove risk to homes by removing rocks.

Action 1: Remove large rocks overhanging existing developments.
Time Frame: Undetermined
Funding: Not applicable
Estimated Cost: Not applicable
Staff: City, County Planning
Background: Developments should include removal or remediation of large rock areas from being dislodged by earthquake or rains.

Action 2: Remove potential rock hazards prior to building homes.
Time Frame: 5 year
Funding: None
Estimated Cost: Unknown
Staff: Planning Departments
Background: Prior to building, require builder/owner to secure or remove possible rock hazard.

EARTHQUAKE

Countywide Problem Identification
Although there is a limited impact to earthquakes, there is an opportunity to evaluate transportation and utilities services could be impacted form secondary effects of earthquake.

Goal 1 – Priority Low

Objective 1.1 Provide for emergency response and relief

Action: Identify and maintain critical transportation and utility services
Time Frame: Ongoing
Funding: Local governments and possible grants
Estimated Cost: Unknown- Determined by the extent of damage anticipated.
Staff: County and City staff.
Background: Critical transportation, utility and communication systems need to be maintained.

DROUGHT

Countywide Problem Identification
Cyclical periods of drought place a strain on community culinary water resources.

Goal 1 – Priority Medium

Objective 1.1 Conserve culinary water by educating the public

Action: Educate the public on the need to be water wise
Time Frame: Ongoing
Funding: City funds
Estimated Cost: minimal
Staff: Water purveyor and newsletter editor
Background: Use a newsletter to educate the public

Objective 1.2 Conserve culinary water by conservation

Action: Maintain and enforce rate policies that encourage water conservation

Time Frame: Ongoing
Funding: County funds
Estimated Cost: minimal
Staff: Water purveyor and newsletter editor
Background: County should evaluate a tiered water system.

Problem Identification: Cyclical periods of drought place a strain on availability of community culinary water and irrigation water resources.

Goal 1 – Priority Medium

Objective 1.1 Meet current and future water needs of community

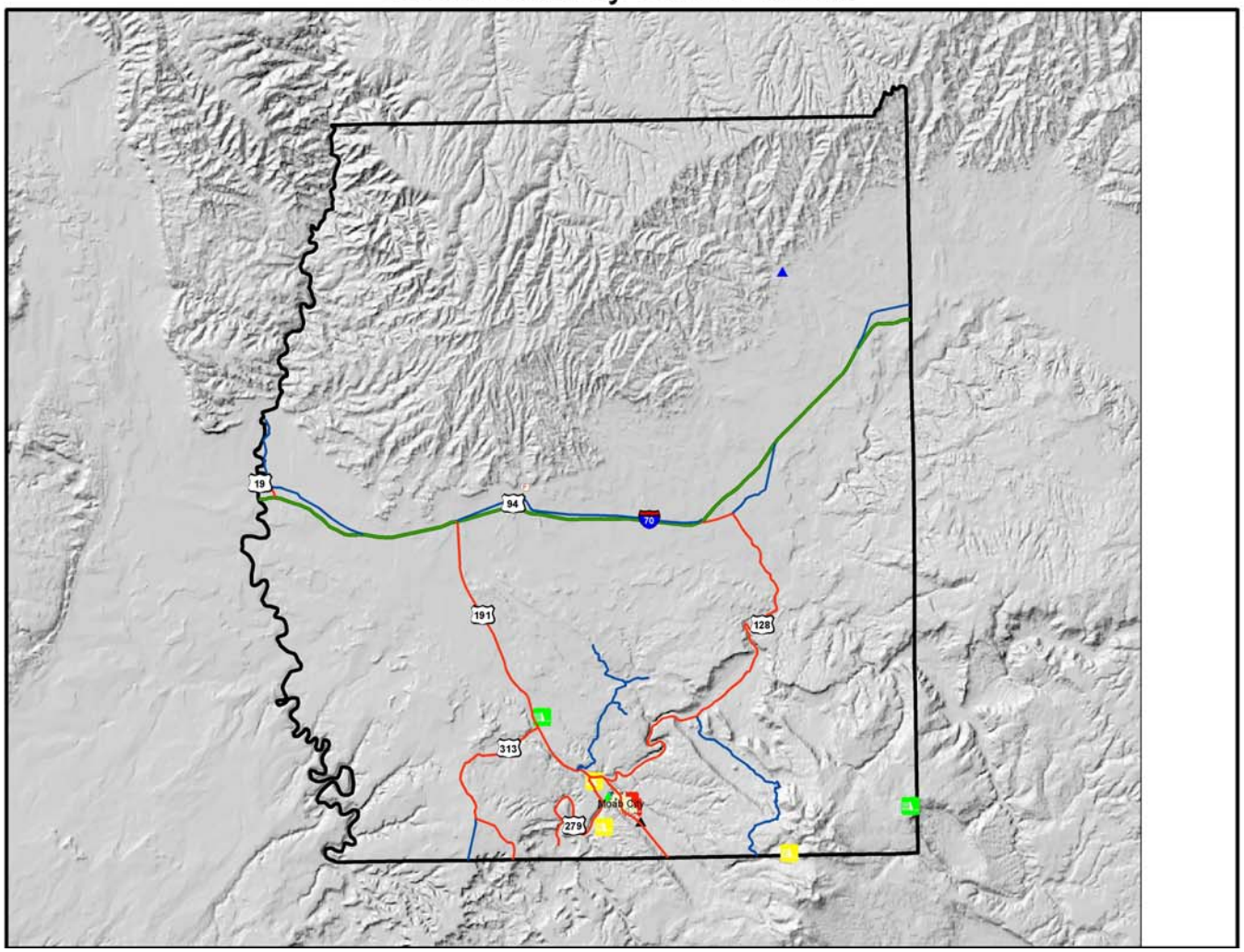
Action: Develop additional source and storage as well as implement conservation plans implemented.
Time Frame: Ongoing
Funding: City funds, State and Federal Government loans and/or grants
Estimated Cost: To be determined
Staff: County Staff, Professional Services, and Contractors
Background: To meet the needs of a community's residential and businesses water users, vigilance in locating new and additional sources as well as increasing storage capacity to meet current needs as well as future need is a must.

H. Maps

All of the following maps have been created for the Pre-Disaster Mitigation Plan using the best available data at the time of the creation of this plan. Because data was obtained from federal and other external sources, Grand County, Moab City, SEUALG and WFRC and its staff members cannot accept responsibility for any errors, omissions, or positional accuracy; therefore there are no warranties, which accompany the maps.

Map 9.1.1 Dam Hazard
Map 9.2.1 Wildfire Risk
Map 9.3.1 Landslide Hazard
Map 9.4.1 Problem Soils

Grand County Dam Hazard



Dam Hazard

- HIGH - Possible loss of life
- MODERATE - Significant property loss
- LOW - Insignificant property loss
- Fire Station
- Police Station
- School
- Waste Water Facility
- Oil Facility
- Communication Facility

N
W E
S

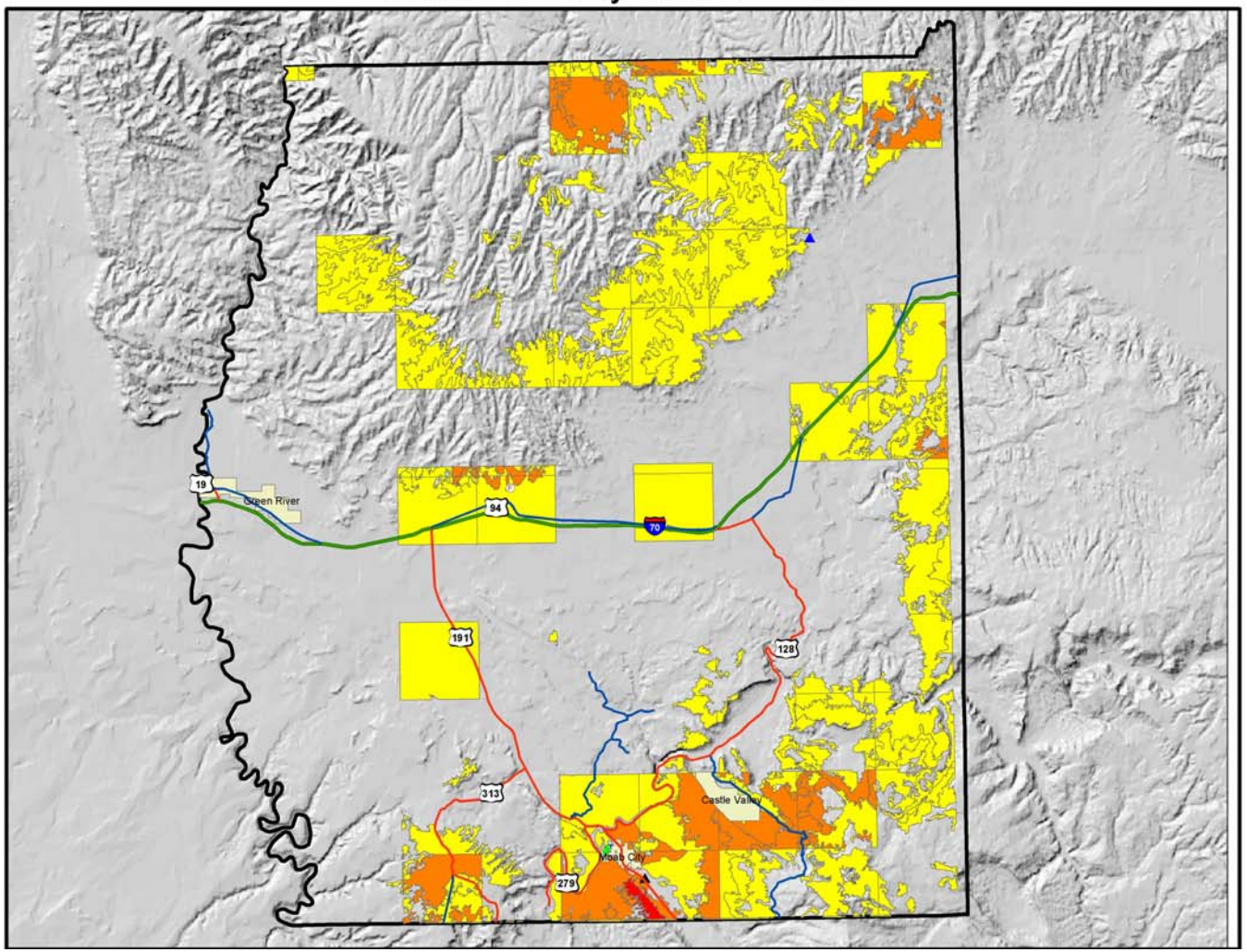
0 4.5 9 18
Miles

Southeastern Association of Local Governments

Data Source: Infromation provided by DESHS, and Utah AGRC

Map produced by the Wasatch Front Regional Council and is "as is". The WFRC cannot accept responsibility for any errors, omissions, or positional accuracy, therefore there are no warranties which accompany this product.

Grand County Wildfire Risk



Wildfire Risk

- Extreme
- High
- Medium
- Fire Station
- Police Station
- School
- Waste Water Facility
- Oil Facility
- Communication Facility

N
W E
S

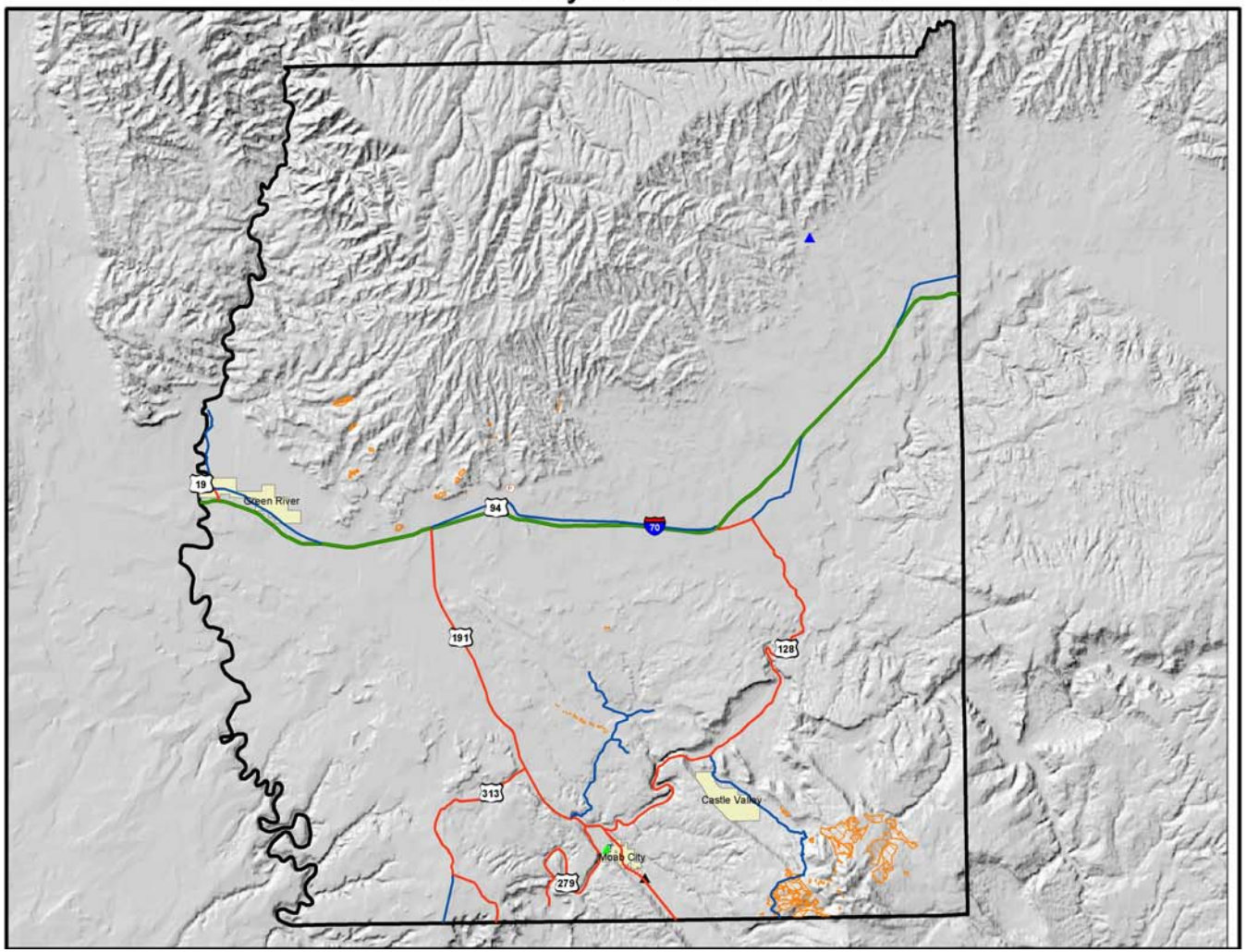
0 4.5 9 18
Miles

Southeastern Association of Local Governments

Data Source: Infromation provided by DESHS, and Utah AGRC

Map produced by the Wasatch Front Regional Council and is "as is". The WFRC cannot accept responsibility for any errors, omissions, or positional accuracy, therefore there are no warranties which accompany this product.

Grand County Landslide Hazard



LANDSLIDES
Fire Station
Police Station
School
Waste Water Facility
Oil Facility
Communication Facility

N
W E
S

0 4.5 9 18
Miles

Southeastern Association of Local Governments

Data Source: Infromation provided by DESHS, and Utah AGRC

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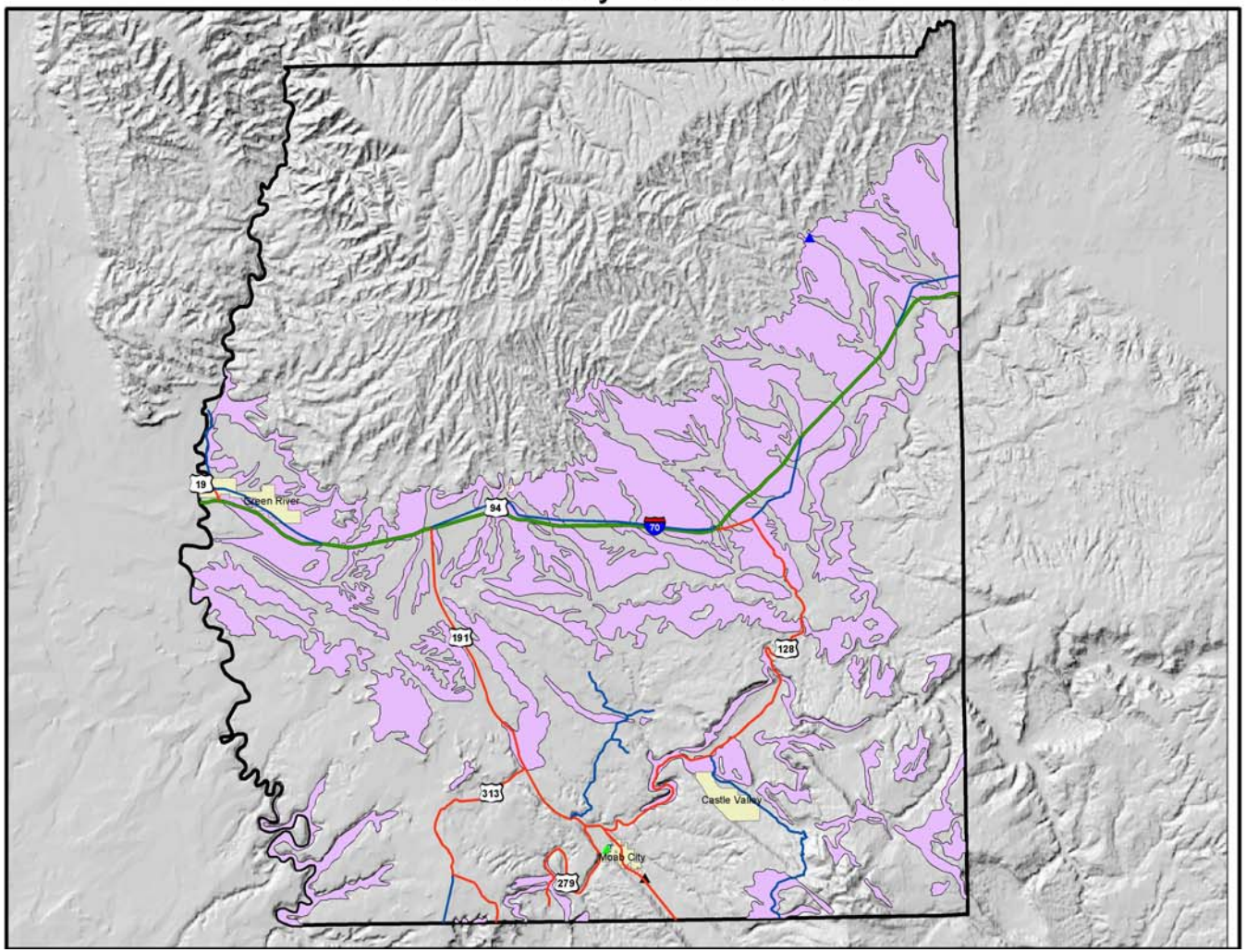
Grand County Problem Soils



Expansive Soil or Rock
Fire Station
Police Station
School
Waste Water Facility
Oil Facility
Communication Facility

N
W E
S

0 4.5 9 18
Miles

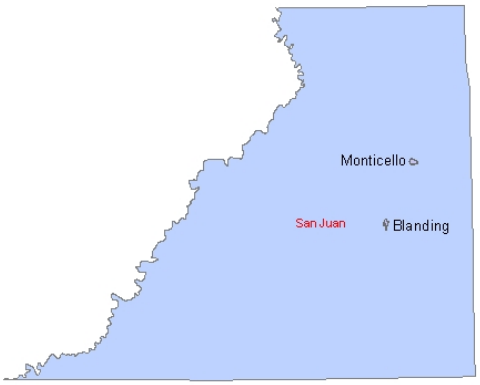
Southeastern Association of Local Governments

Data Source: Infromation provided by DESHS, and Utah AGRC

Map produced by the Wasatch Front Regional Council and is "as is". The WFRC cannot accept responsibility for any errors, omissions, or positional accuracy, therefore there are no warranties which accompany this product.

Part 10. San Juan County

San Juan County includes two main municipalities, Monticello and Blanding. San Juan County is located in the southeastern corner of the state. Other jurisdictions that have been included in the risk assessments including Mexican Hat, Bluff, and Montezuma Creek; these jurisdictions are not incorporated municipalities and have not been mapped.



A. Demographics and Population Growth

The following information involving Population Estimates, Average Annual Rates of Change, and Population and Development Trends is important in understanding the impacts a natural hazard may have on a local community now and in the future (Table 10-1). Monticello and Blanding are the two principal cities in San Juan County. Smaller significant communities include Aneth, Bluff, Eastland, White Mesa, Mexican Hat, Las Sal, Spanish Valley, Holly Village, Oljato, Red Mesa, Monument Valley, Halchita, Goulding, Rainbow Village, and Montezuma Creek. The Navajo Nation and the Ute Mountain Reservations account for 1,231,000 acres (Utah Water Master Plan).

Table 10-1 San Juan County Population

Geographic Area	1990	1997	2000	2020	2050	AARC 1990-2000	Rank by 2000 Population
Blanding Annex Area	3,162		3,162	4,991	7,138	0.0	
Monticello Annex Area	1,806	1,859	1,958	2,565	4,009	0.8	
Spanish Valley		126		166	253		
La Sal		201		264	401		
Bluff		192		250	379		
Mexican Hat		78		102	155		
Eastland Service Area		84		112	170		
Balance of Private Lands		1,034		214	508		
White Mesa Reservation		290		384	582		
Navajo Reservation		6,012		8,225	12,405		
Dennehotso Chapter		32		41	56		
Navajo Mtn. Chapter		427		557	787		
Oljato Chapter		1,769		2,333	3,346		
Mexican Water Chapter		329		541	1,037		
Red Mesa Chapter		1,150		1,706	2,854		
Teec Nos Pos Chapter		105		133	182		
Aneth Chapter		2,225		2,914	4,143		
Total San Juan County	12,621	13,284	14,413	17,273	26,000	1.3	16
Balance of San Juan County	7,653	9,293				2.0	

Table 10-2 Population by County 1980-2030

MCD/ County	1980	1990	2000	2005	2010	2015	2020	2030	AARC 2000-2030
Southeast Region	54,124	49,801	54,180	54,559	57,699	62,754	66,489	67,867	0.75%
San Juan County	12,253	12,621	14,413	14,734	15,823	17,441	18,696	19,459	1.01%
Sources: http://www.governor.state.ut.us/projections/EDPT3.pdf; U.S. Bureau of the Census; Utah Population Estimates Committee; 2002 Baseline Projections, Governor's Office of Planning and Budget, UPED Model System. Notes: AARC is average annual rate of change. 1980 and 1990 populations are April 1 U.S. Census modified age, race and sex (MARS) populations; 2000 populations are April 1 U.S. Census summary file 1 (SF1) populations; all others are July 1 populations.									

B. Economy

San Juan County has three main land-based economic opportunities that are expected to lead growth. These are agriculture, hunting and fishing, and tourism. Other factors that affect economic enrichment involve mineral production, governmental operations, tribal operation, oil and gas exploration, and wildlife recreation (Scherick 63-71).

Economic growth for the first quarter of 2002 was centered on tourism, construction, and health care. The service production industries accounted for much of the job growth and a drop in unemployment during the first quarter of 2002. The current October 2002 unemployment rate is 7.8 percent, a 1.2 percent drop from October 2001 (San Juan County Trends). The 2000 estimated average house value is $123,751 (Annual Statistical).

C. Transportation and Commuting Patterns

San Juan County has no public railway, bus, or passenger air transportation. The major U.S Highways include 191 and 491 (formerly known as "The devil's highway" or route 666). State highway 191extends from the northern San Juan County line south through Monticello, Blanding, Bluff, and Mexican Water on into Arizona. State highway 491 extends from the Colorado State line west through Monticello. State highway 163 runs perpendicular to US 191, extending from Montezuma Creek west through Bluff, and then southwesterly through Mexican Hat and on to the Arizona state line (Scherick 36).

D. Land Use and Development Trends

The Federal Government owns the majority of land within San Juan County. The Bureau of Land Management administers approximately 41% of the land, the National Park Service and the U.S Forest Service handle 11% and 9%, respectively. State lands make up 8% with State Parks occupying less than 1%. Private land ownership consists of roughly 8% of the land base (Scherick 35). The Navajo nation occupies roughly 23% of San Juan County. Development trends indicate that San Juan County will continue to grow. The service and trade industry have had a large impact on population growth and with the above-mentioned population forecast numbers, the county will continue to create more local tourism opportunities.

Risk Assessment

The risk assessment process revealed that wildfire, flood, dam failure, infestation, severe weather, earthquake, and drought have typically affected this geographic region. Risk assessment maps were completed for the mapped hazards and can be viewed at the end of this section (Refer to Part 6 for an explanation of the risk assessment process). According to this data there are 28 critical facilities in San Juan County (Please refer to Appendix C for a complete list of critical facilities for the entire county). Severe weather, earthquake, and drought are considered to be regional hazards and have been profiled as such (Part 4 Regional Data).

1. Wildland Fire

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
	X	Limited	10-25%
		Critical	25-50%
		Catastrophic	More than 50%
Probability	X	Highly Likely	
		Likely	
		Possible	
		Unlikely	
Location	See map in Section H. Countywide, URWIN areas around Monticello and Blanding.		
Seasonal Pattern or Conditions	Summer months. Areas affected by drought and/ or heavily overgrown and dry brush and debris. Lightning and human triggers.		
Duration	Wildfires typically last days but can last months, depending on climate and fuel load as well as resources (financial, manpower) to extinguish the fire.		
Analysis Used	Review of plans and data provided by US Forest Service, National Climate Center, FEMA, AGRC, County Hazard Analysis Plans, and DESHS.		

Description of Location and Extent

A wildfire is an uncontrolled fire spreading through both naturally occurring and non-native vegetative fuels. Often wildfires threaten nearby structures. Wildfires often begin unnoticed and spread quickly. They are usually signaled by dense smoke that fills the area for miles around. Wildfire can cover a large geographic area, can be ignited by natural or human sources, and are hard to predict. According to the local emergency manager, the county had fires in 1994, 1996, 2001, and 2002. They were all isolated but did considerable damage to property and suppression was costly. The Division of Emergency Services and Homeland Security list below five categories to wildfire risk. Wildfire maps provided by DESHS show five categories of wildfire risk:

- Extreme
- High
- Medium
- Low
- Very Low

These ratings cover all of San Juan County and are based on the type and density of vegetation in each area. Additional factors influencing wildfires such as weather conditions, wind speed and direction are not considered in this risk assessment.

Vulnerability Assessment

The following table includes the number of commercial, and residential structures inside extreme, high and moderate wildfire risk areas within San Juan County. The population within each of the areas is also included (Table 10-3).

Table 10-3 Households and Population in Wildfire Area

	Extreme Risk	High Risk	Moderate Risk
Residential Units/Replacement Cost	144/$11,323,728	65/$5,111,405	170/$13,368,290
Population	456	84	328

Table 10-4 details the annual sales of the businesses inside each wildfire risk area, and the assessed value of residential property in each wildfire risk area. Residential loss estimates do not include contents. Including the value of contents would increase the values listed by 50%.

Table 10-4 Businesses in Wildfire Area

City Name	Businesses in Extreme/ Annual Sales	Businesses in High/ Annual Sales	Businesses in Moderate/ Annual Sales
Blanding	6/ $3,900,000	4/ $900,000	5/ $6,900,000
Monticello	No known risk	No known risk	47/ $54,900,000
Montezuma Creek	No known risk	No known risk	1/ $600,000

Table 10-5 contains the number of acres in each wildfire risk area, within the municipal boundaries of the following cities in San Juan County.

Table 10-5 Wildfire Risk Area

	Acres of Extreme	Acres of High	Acres of Moderate
Monticello	90.93	92.16	90.93
Blanding	162.17	109.44	15.79

The following tables list the critical facilities and infrastructure within Extreme, High or Moderate wildfire risk areas (Table 10-6, 10-7). Refer to Table 10-8 for a list of the recorded fire history within the county.

Table 10-6 Critical Facilities in Wildfire Zones

Critical Facility	Name	Location
Oil Facility	Gary-Williams Energy Facility	¾ Mile South of Montezuma, Montezuma Creek
Oil Facility	Unocal Lisbon Plant	
Natural Gas Facility	Northwest Pipeline	22 Miles South of hwy 191, Near Moab
School	Monticello High	Monticello
School	Monticello School	Monticello

Table 10-7 Infrastructure in Wildfire Area

Item	Length (Miles)	Replacement Cost
Local Roads	230.65	$461,300,000
State Highways	144.95	$349,846,962
US Highways	0.00	$0
US Interstates	0.00	$0
Power Lines	111.50	$5,383,220
Gas Lines	45.24	$10,920,484

Table 10-8 Historical Wildfires

Date	Fire Name	Cause	Size
6/8/86	White Mesa	Miscellaneous	E
6/1/87	White Mesa # 2	Incendiary	D
6/18/87	McCracken Mesa	Miscellaneous	E
6/19/87	White Mesa # 4	Incendiary	E
6/23/87	White Mesa # 6	Debris Burn	D
7/4/87	Tank Draw	Equipment	F
8/15/87	Two Mile Creek	Lightning	D
6/15/89	Pehrson	Lightning	E
7/23/90	Horny Toad	Lightning	D
8/9/90	Alfred Frost	Lightning	D
6/14/94	Willow Basin	Equipment	F
6/25/94	Haller (Wheatfield)	Lightning	D
6/29/94	Mustang	Lightning	D
7/14/94	Iron Canyon	Lightning	D
7/14/94	Peters Hill (Iron Canyon)	Miscellaneous	D
3/21/96	Montezuma	Debris Burn	D
6/8/96	Dove Creek	Lightning	D
6/21/96	Eastland	Lightning	D
7/16/97	Wray	Lightning	D
7/17/97	Cajon Mesa	Lightning	E
6/1/98	Aneth Point	Cigarette	D
7/9/99	McCracken	Lightning	E

2. Flood

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
	X	Limited	10-25%
		Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
	X	Likely	
		Possible	
		Unlikely	
Location	See map in Section H, the San Juan and Colorado Rivers and their respective larger tributaries.		
Seasonal Pattern or Conditions	Spring, Cloudburst Storms and Heavy Snowfall Runoff.		
Duration	Flooding can last anywhere from hours to days and even months.		
Analysis Used	Review of FIS, FIRM, Army Corp of Engineers Flood Study, Hazard Analysis Plans, GIS data, and have worked with local residents of the community.		

Description of Location and Extent

The WFRC, San Juan County GIS staff members, and Utah DESHS have reviewed the county's most recent FIRM and FIS, EOP, Hazard Analysis Plan, and have worked with local residents of the community to compile all available data to profile the flooding hazard in San Juan County. A rudimentary Flood Hazard Identification Study has also been compiled by the Army Corps of Engineers in 2003 (Appendix E).

The following communities are situated in floodplains and have suffered property damage in the past. McElmo Creek, Comb Wash, Cottonwood Wash, and Montezuma Creek near Bluff, Cottonwood Wash near Blanding, Butler Wash near Bluff, Comb Wash near Bluff and Blanding, White Canyon near Hite, and Lime Creek near Mexican Hat.

Bluff is located in an alluvial fan below Cottonwood Wash, and therefore is in a floodplain area as well as in a shallow ground water zone. Mexican Hat is located near the San Juan River and is also in the floodplain. The city of Blanding resides on or near expansive soils; when water is introduced into these types of soils they expand and damage or destroys foundations in homes and businesses.

Monticello, Bluff, Blanding, and Mexican Hat are likely to experience another flood event in the future. Flash flooding is also possible in San Juan County in gullies, washes and canyons.

Vulnerability Assessment

Due to the lack of digitized floodplain maps potential dollar loss estimates were unable to be completed during the making of this plan.

3. Dam Failure

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
		Limited	10-25%
		Critical	25-50%
	X	Catastrophic	More than 50%
Probability		Highly Likely	
		Likely	
	X	Possible	
		Unlikely	
Location	See map in Section H Dam locations are mainly located in the mid-eastern portion of the county.		
Seasonal Pattern or Conditions	Rainy Day Failure happens mainly during heavy precipitation events, can have some warning time. Sunny Day Failure happens with no warning at all can happen at anytime.		
Duration	Hours, Days. Depends on spillway type and area, maximum cfs discharge, overflow or breach type, dam type. Refer to Dam Inventory for more information.		
Analysis Used	Review of BOR inundation maps and plans, FIS, Water Rights, Utah Division of Water Rights and Dam Safety, local input.		

Description of Location and Extent

Twenty-eight dams are located in San Juan County with only four dams listed as having a high threat rating. A high threat rating means there is a possibility of life being lost due to dam failure. Two dams are listed, as having a moderate hazard rating, meaning there would be significant downstream property loss if the dam were to fail. The remaining seventeen dams have a low hazard rating; if a dam failure were to occur there would be insignificant property loss, however they should still be monitored (Table 10-9). The classification of a high hazard dam does not mean that the dam has a high probability of failure. Dam safety hazard classifications simply delineate the downstream consequences if a dam were to fail (Table 10-10). Potential dam failure in San Juan County is rated as "possible." If a dam were to breach in the county, the cities identified in Table 10-10 would be affected.

Table 10-9 San Juan County Dam Risk

Dam Name	Hazard Risk
1. Kens Lake	High
2. Lloyds Lake/ Monticello	High
3. Starvation Canyon	High
4. Recapture Creek	High
5. Blanding City #3	Moderate
6. Blanding City #4	Moderate
7. Camp Jackson	Moderate
8. Dry Wash #2	Moderate
9. Gordon	Moderate
10. Keller	Moderate
11. Monticello Lake	Moderate
12. Rattlesnake Ranch #1, Upper	Moderate
13. Rattlesnake Ranch #2, Lower	Moderate
14. Bailey, Upper	Low
15. Bankhead, Lower	Low
16. Blanding Wastewater Winter Storage	Low
17. Dugout	Low
18. Iron Springs	Low
19. Monticello City #1	Low

20. Monticello City #2	Low
21. Monticello City #3	Low
22. Provancha	Low
23. Rio Algom, Lower	Low
24. Rio Algom, Upper	Low
25. Snyder #2	Low
26. White Mesa Tailings #1	Low
27. White Mesa Tailings #2	Low
28. White Mesa Tailings #3	Low

Monticello
Lloyds Lake is a High hazard dam owned by San Juan Water Conservancy District and was completed in 1984. The reservoir storage at spillway crest is 3,500 acre-feet and the reservoir storage at dam crest is 4,300 acre-feet. The spillway type is an open channel and the maximum dam breach flow would be 86,000 cfs with a 13 square mile drainage basin area. The first downstream town is Monticello 1 mile away.

Blanding
Starvation Canyon Reservoir is a High hazard dam owned by Blanding City and was completed in 1985. The reservoir storage at spillway crest is 600 acres and the reservoir storage at dam crest is 875 acres. The spillway type is an open channel and the maximum dam breach flow would be 28,000 cfs with a 1 square mile drainage basin area. The first downstream town is Blanding 3 miles away.

Recapture Creek has a High hazard dam rating. It is owned by San Juan Water Conservancy and was completed in 1984. The reservoir storage at spillway crest is 9,319 acre-feet and the reservoir storage at dam crest is 16,000 acre-feet. The spillway type is open channel and the maximum dam breach flow would be 220,000 cfs with a 61 square mile drainage basin area. Recapture Creek does not have a downstream town; the dam water would flow into the San Juan River.

Table 10-10 Dam Breach Downstream Town

Dam Name	First Downstream Town	Distance in miles
Bankhead, Lower	La Sal	5
Blanding City #3	Blanding	4
Camp Jackson	Blanding	17
Dry Wash #2	Blanding	14
Gordon	Monticello	5
Kens Lake	Moab	6
Lloyds Lake	Monticello	1
Monticello City #1	Monticello	1
Monticello City #2	Monticello	1

Vulnerability Assessment
The risk assessment values for dam failure were difficult to analyze due to the quality and age of the dam inundation maps from the Dam Safety Section of Utah Water Rights. The municipalities, roads, critical facilities, and GIS layers were superimposed over the dam identification layers. This analysis reveals the geographic extent of the dams and the critical facilities within the hazard areas. This analysis could not identify potential dollar loss estimates using the available data.

4. Infestation

Hazard Profile

Potential Magnitude		Negligible	Less than 10%
	X	Limited	10-25%
		Critical	25-50%
		Catastrophic	More than 50%
Probability		Highly Likely	
	X	Likely	
		Possible	
		Unlikely	
Location	Agricultural lands, forested areas, areas of extreme drought.		
Seasonal Pattern or Conditions	Summer, drought related		
Duration	Months to years		
Analysis Used	Reviewed information provided by UGS, DESHS, AGRC, Idaho's Forest Health Protections agency, Utah Forestry Fire and State Lands, Utah Forest Service, Utah State University Extension Service, and local input.		

Description of Location and Extent

San Juan County has experienced infestation problems in the past. The following information has been gathered from surveyors from Boise, Idaho's Forest Health Protection with help from the Forest Health Coordinator from Utah Forestry Fire and State Lands:

In 1998, 14 % of San Juan County was surveyed (or 690,067 out of 5,065,358 total acres). The survey identified 291 acres that were affected by Mountain Pine Beetle Ponderosa, 74 acres affected by Douglas-Fir Beetle, 198 acres affected by the Spruce Beetle, 398 acres affected by Aspen Blight, 354 acres from Sub-Alpine Fir Mortality Complex, and 5 acres from Pinyon Mortality.

In 1999, 8 % of San Juan County was surveyed or 411,622 out of 5,065,358 total acres. The survey identified that 186 acres were affected by Mountain Pine Beetle Ponderosa, 20 acres affected by Douglas-Fir Beetle, 429 acres affected by the Spruce Beetle, 40 acres affected by Fir Engraver Beetle, 1,349 acres from Sub-Alpine Fir Mortality Complex, and 15 from Aspen defoliation.

In 2000, 8 % of San Juan County was surveyed or 417,045 out of 5,065,358 total acres. The survey identified that 243 acres were affected by Mountain Pine Beetle Ponderosa, 77 acres affected by Douglas-Fir Beetle, 407 acres affected by the Spruce Beetle, 140 acres affected by Fir Engraver Beetle, 802 acres from Sub-Alpine Fir Complex, 251acres from Aspen defoliation, and 461 acres from Needle Disease Ponderosa.

In 2001, 10 % of San Juan County was surveyed or 482,600 out of 5,065,358 total acres. The survey identified that 383 acres were affected by Mountain Pine Beetle Ponderosa, 94 acres affected by Douglas-Fir Beetle, 506 acres affected by the Spruce Beetle, 226 acres affected by Fir Engraver Beetle, 2,287 acres from Sub-Alpine Fir Complex, 295 acres from Aspen Blight, 34 avalanche, and 3,337 acres from Frost Damage Oak.

In 2002, 10 % of San Juan County was surveyed or 499,557 out of 5,065,358 total acres. The survey identified that 191 acres were affected by Mountain Pine Beetle Ponderosa, 219 acres affected by Douglas-Fir Beetle, 82 acres affected by the Spruce Beetle, 31 acres affected by Fir Engraver Beetle, 1,463 acres from Sub-Alpine Fir Complex, and 64 Forest Tent Caterpillar.

During 2002 and 2003, Armyworms and Grasshopper crickets have been a major problem in the entire county of San Juan.

Cutworms have also been a problem within the cities and communities of San Juan County. This type of infestation has a direct correlation to drought and is considered to be one of the secondary threats of drought. San Juan County is located within Climate Division 7. This division experiences a drought almost every two years. Each drought can last five or more years.

Infestation will continue to happen in the future because of Utah's climate. Drought, vegetation, and species diversity are all affected by climate and will continue to be a limited problem for Utah's forestlands and cities and towns.

Vulnerability Assessment
Potential loss estimates were unable to be completed during the making of this plan due to the lack of digitized datasets related to infestation. Future studies and maps need to be completed to fully understand this hazard.

F. Hazard History

Identifying past hazard events is key in predicting where future events are likely to occur. The following available relevant information such as date, location, area impacted, and damage costs are identified in the table below (Table 10-11). Due to the frequency and geographic extent of problem soil, and some severe weather events past events have not been recorded and are therefore not identified in the table below.

Table 10-11 Hazard Histories

Hazard	Date	Location	Critical Facility/ Area Impacted	Comments
Tornado	May 21, 1947	San Juan County		F0 on the Fujita Scale.
Tornado	May 23, 1947	San Juan County		F0 on the Fujita Scale.
Flash Flood	August 17, 1955	Monticello	Northeast Section of City	Damage to homes and businesses
Flood	August 2, 1956	Monticello		City and some homes were flooded; one motel resulted in $50,000 in damage.
Flood	July 31, 1965	Monticello		Farmland and crop damage, Johnson Creek Road damaged.
Flood	August 1, 1968	Bluff		Residential and business property damaged. Damage estimated over $16,000.
Winter Storm	1974	San Juan County		Runoff damage
Winter Storm	1986	Countywide		Road closures and property damage.
Winter Storm	1992	Countywide		Road closures and property damage.
Blizzard	January 1, 1997	Countywide		3 deaths, 50 injuries and $40 million in property damage.
Winter Storm	April 2, 1997	Countywide		No property damage no loss of life
Winter Storm	October 15, 1998	Countywide		Several thousand dollars of property damage.
Rainstorm	October 30, 1998	Bluff		No significant damage.
Winter Storm	December 19, 1998	Countywide		Several thousand dollars in property damage.
Wildfire	June 16, 1999	Monticello		No property damage or loss of life.
Wildfire	July 17, 2000	Blanding		No property damage or loss of life.
Wildfire	July -August, 2000	Monticello		
Funnel Cloud	August 20, 2000	Mexican Hat		
Funnel Cloud	August 21, 2000	Monticello		

G. Mitigation Goals, Objectives, Actions

Mitigation Strategies Workbook
San Juan County

Valuation
The following table shows possible damage costs of identified hazards based on maps of hazard areas and on records of previous events (Table 10-12).

Table 10-12

Type of Hazard	Possible Damage Costs (approx.)
Severe Weather	$5,000-$10,000 per event
Flooding	$10.5 Million (flood hazard area)
Wildfire	$9 Million (wildfire risk area)
Drought	Requires further study
Landslide	Requires further study
Dam Failure	$3 Million (rebuild golf course)

Prioritization
The following table summarizes each of the hazards, rated according to Probability (the likelihood of an event occurring in a given period) and Severity (lives and property that would be affected). None of the hazards were rated as Highly Likely and Catastrophic (Table 10-12).

Table 10-12

Type of Hazard	Probability	Severity	Rank
Severe Weather	Highly Likely	Limited	1
Flooding	Possible	Critical	2
Wildfire	Possible	Limited	3
Drought	Highly Likely	Negligible	4
Landslide	Possible	Negligible	5
Dam Failure	Not Likely	Limited	6

SAN JUAN COUNTY
UTAH PORTION OF THE NAVAJO NATION
MITIGATION GOALS AND OBJECTIVES

Wildfire

Problem Identification: Provide fire breaks around residences and commercial business that may be of threat from a wildfire. Most of the area does not have a high impact potential from wildfire.

Goal 1-Priority Medium

Objective 1.1 - Provide fire breaks around residences and commercial business that may be of threat from a wildfire by blanding and other methods.

Action: Blade firebreaks as needed
Time Frame: Ongoing
Funding: Local, Chapter, Tribal and Federal Funds
Estimated Cost: 5,000 annually
Staff: Local, chapter, tribal and federal agencies
Background: Work with chapter officials to determine areas for firebreaks

Problem Identification: Specific areas of the Utah strip are susceptible to wildland fire danger.

Goal 2- Priority Low

Objective 1.2 - Reduce the threat in Navajo Mountain and Aneth/Red Mesa areas.

Action: Map potential areas on the Utah Strip that may have wildland fire threat.
Time Frame: next fiscal year
Funding: Local, Tribal and Federal
Estimated Cost: Minimal
Staff: Local, tribal and federal agencies
Background: Review fire reports from previous years to determine threat areas.

Landslide

Problem Identification: Potential landslides on the Utah portion of the Navajo Nation, particularly those areas that have had prior threats or incidents.

Goal 1- Priority Medium

Objective 1.1 - Map areas on the Utah portion that have had historical incidents of landslides.

Action: Review historical information and reports, interview with citizens.
Time Frame: FY2005
Funding: Local, Chapter, Tribal and Federal funding.
Estimated Cost: 1000.00
Staff: County, Chapter, Tribal, and Federal Agencies.
Background: Historical information and interviews/

Problem Identification: Potential risk of structures in mountainous areas to be damaged by landslides.

Goal 2-Priority Medium

Objective 1.2 Reduce potential of landslides on county and state highways.
Action: Removal of material, placement of larger culverts, re-routing of existing highways.
Time Frame: Undetermined
Funding: Local, State, Chapter, Tribal and Federal
Estimated Cost: Unknown
Staff: Local, State, Chapter, Tribal and Federal
Background: Soil surveys and other engineer surveys, historical incidents.

Earthquake

Problem Identification: Unknown number of seismically unsafe structures around the Utah portion of the Navajo Nation. The risk based on historical incidents has not been high.

Goal 1- Priority Low

Objective 1.1 - Public Awareness

Action: Conduct pubic awareness campaign.
Time Frame: Ongoing
Funding: Federal and state grants, local sources.
Estimated Cost: Unknown
Staff: Agency personnel and volunteers.
Background: Contact DESHS earthquake program specialist. Enhance earthquake instructions in school.

Goal 2- Priority Low

Objective 1.2 - Community Emergency Response Teams (CERT)

Action: Assist with the organize Community Emergency Response Teams by Navajo Nation, if it is determined to be a local priority.
Time Frame: Ongoing
Funding: Federal, Tribal, and State grants.
Estimated Cost: Unknown
Staff: Tribal, State and local personnel.
Background: Navajo Nation Department of Emergency Management, Utah Chapters, and Utah.

Flood

Problem Identification: Identify and map areas that are prone to flood based on historical reports and incidents and encourage flood loss reduction measures

Goal 1- Priority High

Objective 1.1 - Identify flood prone areas on the Utah portion of the Navajo Nation.

Action: Mapping of potential flood areas.
Time Frame: FY2005
Funding: unknown
Estimated Cost: $5000.00
Staff: Local, Chapter, Tribal and State
Background: Contact DESHS flood map specialist.

Problem Identification: Reduce impact on State and County Highways from Flooding.

Goal 2- Priority High

Objective 1.2 - Reduce or eliminate flooding impacts on State and County highways based on historical incidents/

Time Frame: Ongoing
Funding: State, Local, and Federal...
Estimated Cost: Unknown.
Staff: County and State
Background: County Road and UDOT, NNOT and Engineers.

Problem Identification: Many reservoirs have been filled in and/or broken through out the years and have not been repaired.

Goal 3- Priority Medium

Objective 1.3 - Repair numerous reservoirs throughout the Utah portion of the Navajo Nation.

Action: Repair and/or clean out reservoirs.
Time Frame: Ongoing
Funding: State, Federal, and Tribal
Estimated Cost: Unknown.
Staff: Federal, Chapter and Tribal
Background: Chapter and Farm Service Agency Personnel

Problem Identification: Reduce economic loss due to flooding

Goal 4 – Priority High
Objective 1.1 Promote flood insurance throughout the County

Action: Create outreach document promoting flood insurance and include in local newspaper(s), libraries, and other public buildings.
Time Frame: 1 year
Funding: Minimal
Estimated Cost: Unknown
Staff: County and City Floodplain Administrators, State Floodplain Manager, DES
Background: General public is usual not aware they can purchase flood insurance.

Drought

Problem Identification: Water Storage

Goal 1- Priority High

Objective 1.1 - Develop more water storage tanks and systems for culinary and agriculture use on the Utah portion of the Navajo Nation.

Action: Conduct feasibility study.
Time Frame: Unknown
Funding: Unknown
Estimated Cost: Unknown
Staff: County, Chapter, Tribal, Federal (IHS)
Background: Chapter, Tribal, and Farm Service Agency personnel.

Problem Identification: Water storage for animals.

Goal 2- Priority Medium

Objective 1.2 - Develop more reservoirs on the Utah portion of the Navajo Nation.

Action: Develop new reservoir.
Time Frame: Ongoing
Funding: State and Federal grants
Estimated Cost: Unknown
Staff: NRCS, UACD, USU Extension, etc.
Background: NRCS, Chapter, USU Extension, Tribal

Problem Identification: Lack of public awareness of efficient water usage.

Goal 3- Priority High

Objective 1.3 - Education

Action: Use several ways in educating the public on efficient water usage.
Time Frame: Ongoing
Funding: State and Federal grants, federal program, NTUA
Estimated Cost: Unknown
Staff: NRCS, UACD, USU Extension, IHS and NTUA.
Background: Research problem areas. Create programs to make the public aware. Use newsletters and the newspapers. Hold field trips.

Insect Infestation

Problem Identification: Infestations of Army Cut-Worms and other insects on the Utah portion of the Navajo Nation.

Goal 1- Priority Medium

Objective 1.1 - Have government agencies develop better control methods on federal grounds.

Action: Improve control methods on reservation lands/.
Time Frame: 5 years
Funding: Federal government.
Estimated Cost: Unknown
Staff: APHIS, Tribal other federal and state agencies.
Background: Educate land owners to control methods and more into their lifecycles.

Severe Weather

Problem Identification: Wind damage to property and resulting loss of power to areas on the Utah portion of the Navajo Nation, prepare residents to have 72 hours kits and provide for residents and animals in the event of severe weather, such as high winds, winter storms, mud from rains and snow storms, etc.

Goal 1- Priority Medium

Objective 1.1 - Reduce power outages.

Action: Improve infrastructures to minimize power outages.
Time Frame: Ongoing
Funding: Multiple groups.
Estimated Cost: Unknown
Staff: Private people and local utilities (UPL and NTUA)

Background: Contact utilities on current situation. Gather data on power outage, and frequency of outages.

Problem Identification: Education for residents.

Goal 2- Priority High

Objective 1.2 – Provide education to resident of the Utah portion of the Navajo Nation.

Action: Provide education to residents including 72-hour kits, etc.
Time Frame: Ongoing
Funding: County, State, Tribal, and Federal
Estimated Cost: 5000.00
Staff: Chapters, County, Tribal, Federal, and USU Extension
Background: CERT Teams, Health Officials, and Newsletters

Problem Identification: Snowstorms, summer thunderstorms, hail, and high winds over southeastern Utah have a dramatic effect on regional commerce, transportation, and daily activity and are a major forecast challenge for local meteorologists.

Goal 3 – Priority High
Objective 1.1 Protect County from adverse affects of severe weather

Action 1: County participates in the Storm Ready program.
Time Frame: 2 Year
Funding: State and Federal
Estimated Cost: Unknown
Staff: City and County Emergency Management
Background: Set up within the county emergency management and encourage all cities to participate, all requirements of the National Weather Service Storm Ready program.

Problem Soils

Problem Identification: Wind Erosion

Goal 1- Priority Medium

Objective 1.1 - Reduce damage to crops, grazing lands, etc. from wind erosion.

Action: Improve conditions to reduce soil erosion.
Time Frame: Ongoing
Funding: USDA government programs.
Estimated Cost: Unknown
Staff: NRCS, UACD, USU Extension
Background: Unknown

Rockslide

Goal 1
Minimize safety risk and property damage to Bluff Town due to Rockslide

Objective 1.1: Develop an Emergency rockslide reaction plan
Action: Coordinate with emergency response.
Timeframe: 1 year
Funding: Federal Grant; amount unknown
Staff: Bluff Fire Department
Priority: Low

Wildfire

Goal 1
Protect Lives and Property from Wildfire

Objective 1.1: Maintain adequate fire breaks between wildfire zones and residences
Action: Thin Tamarisk/undergrowth along river bottom.
Timeframe: 1 Year
Funding: Federal Grant; amount unknown
Staff: Bluff Fire Department
Priority: Medium

HAZMAT Spill

Goal 1
Protect Lives and Property from Hazardous Material Spillage

Objective1.1: Prevent a vehicle transporting hazardous material from flipping over on US 191 in Bluff by the sharp corner near Bluff Elementary School, forcing an evacuation of the school and several residences in town and re-routing traffic through town.
Action: Post Better signage;
Timeframe: 1 Year
Funding: Federal Grant; amount unknown
Staff: Bluff Fire Department
Priority: Medium

Action: Erect cement protective railings around corner;
Timeframe: 1 Year
Funding: Federal Grant; amount unknown
Staff: Bluff Fire Department
Priority: Medium

Action: Develop an emergency HAZMAT response plan.
Timeframe: 1 Year
Funding: Federal Grant; amount unknown
Staff: Bluff Fire Department
Priority: Medium

Action: Coordinate with UDOT, county HAZMAT team.
Timeframe: 1 Year
Funding: Federal Grant; amount unknown
Staff: Bluff Fire Department
Priority: Medium

Goal 2
Protect Lives and Property from Hazardous Waste Tailings

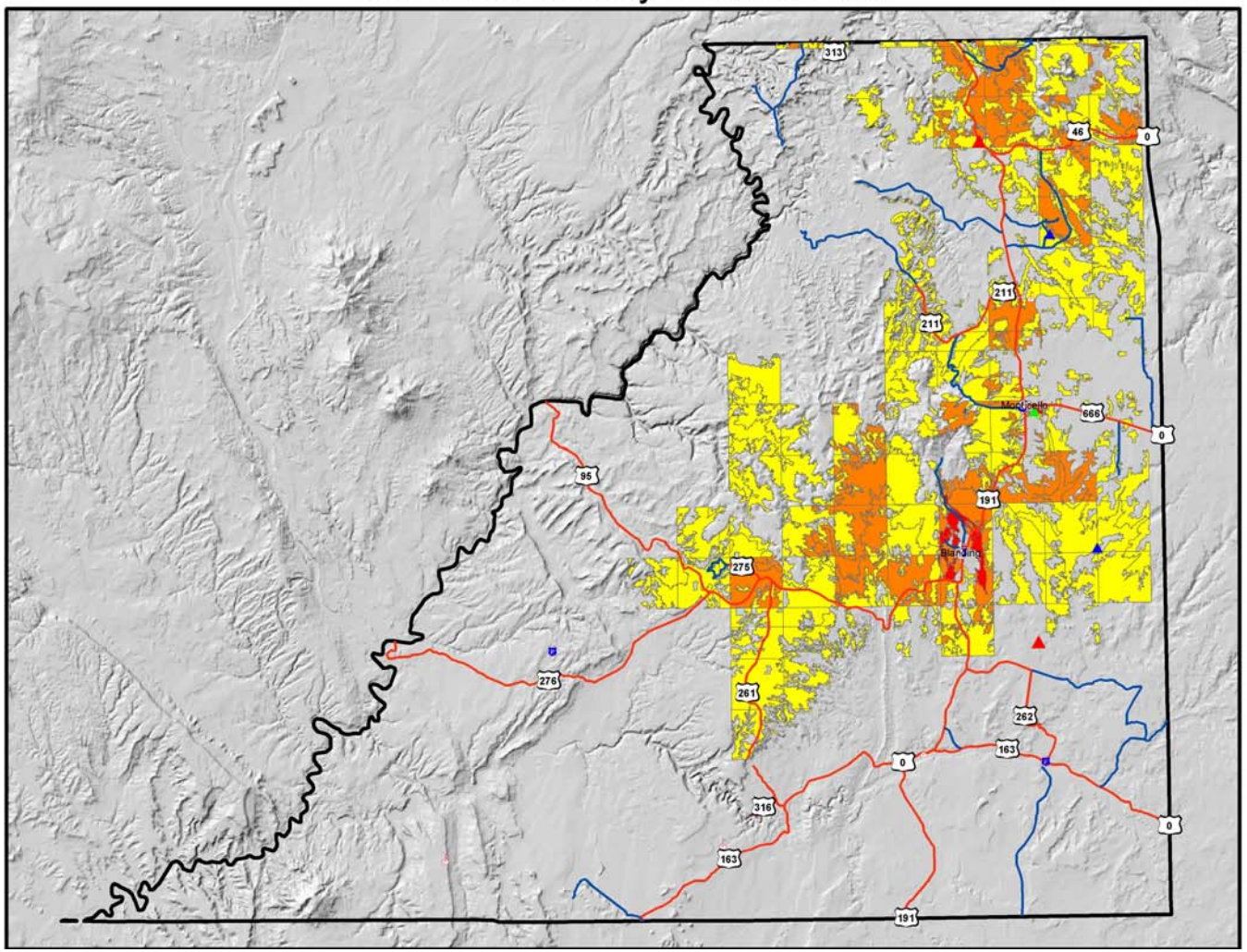
Objective 2.1: Prevent White Mesa Uranium Mill contaminates from entering the town's sole source of drinking water by Working to prevent additional radioactive waste from being stored at White Mesa Mill.
Action: Garner Continuing support of community in these efforts.
Timeframe: Ongoing
Funding: None
Staff: Bluff Service Area
Priority: Low

H. Maps

All of the following maps have been created for the Pre-Disaster Mitigation Plan using the best available data at the time of the creation of this plan. Because data was obtained from federal and other external sources SEUALG, WFRC and its staff members cannot accept responsibility for any errors, omissions, or positional accuracy; therefore there are no warranties, which accompany the maps.

Map 10.1.1 Wildfire Risk
Map 10.3.1 Dam Hazard

San Juan County Wildfire Risk



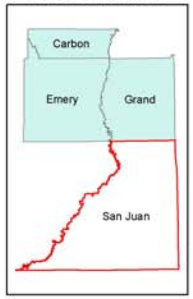
Wildfire Risk

- Extreme
- High
- Medium
- Fire Stations
- Police Stations
- Schools
- Waste Water Facility
- Oil Facility
- Naural Gas Facility

N
W E
S

0 5 10 20
Miles

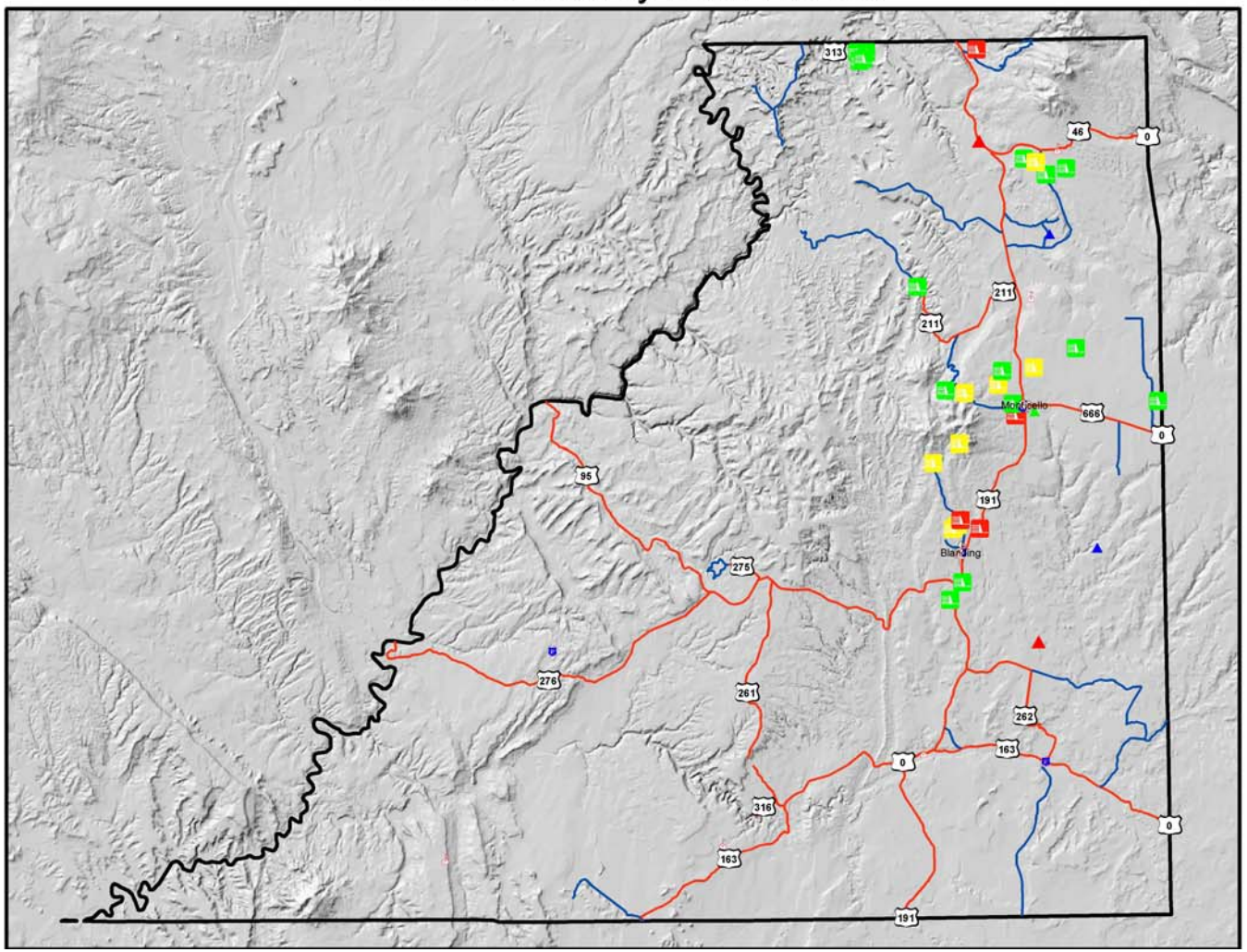
Southeastern Association of Local Governments



Data Source: Infromation provided by DESHS, and Utah AGRC

Map produced by the Wasatch Front Regional Council and is "as is". The WFRC cannot accept responsibility for any errors, omissions, or positional accuracy, therefore there are no warranties which accompany this product.

San Juan County Dam Hazard



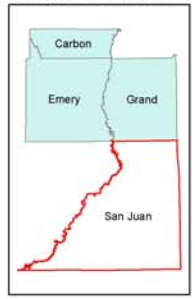
DAM HAZARD

- HIGH - Possible loss of life
- MODERATE - Significant property loss
- LOW - Insignificant property loss
- Fire Stations
- Police Stations
- Schools
- Waste Water Facility
- Oil Facility
- Naural Gas Facility

N
W E
S

0 5 10 20
Miles

Southeastern Association of Local Governments



Data Source: Infromation provided by DESHS, and Utah AGRC

Map produced by the Wasatch Front Regional Council and is "as is". The WFRC cannot accept responsibility for any errors, omissions, or positional accuracy, therefore there are no warranties which accompany this product.

Part 11. Maintenance and Implementation Procedures

Monitoring, Evaluating and Updating the Plan
Periodic monitoring and reporting of this plan is required to ensure that the goals and objectives for the region are kept current and that local mitigation efforts are being carried out. This plan has therefore been designed to be user-friendly in terms of monitoring and implementing.

Annual Reporting Procedures
This plan shall be reviewed annually, as required by the Utah DESHS, or as situations dictate such as following a disaster declaration. Each year the Wasatch Front Regional Council, Community Development Department and/ or Southeastern Association of Local Governments will review the plan and ensure the following:

1. The Executive Director will receive an annual report and/or presentation on the implementation status of the plan.

2. The report will include an evaluation of the effectiveness and appropriateness of the mitigation actions proposed in the plan.

3. The report will recommend, as appropriate, any required changes or amendments to the plan.

If the Executive Director, participating Jurisdictions, or Utah DESHS determines that a modification of the plan is warranted, an amendment to the plan may be initiated.

Revisions and Updates
Periodic revisions and updates, based on funding, of the plan are required to ensure that the goals and objectives for the region are kept current. More importantly, revisions may be necessary to ensure the plan is in full compliance with Federal regulations and State statutes. This portion of the plan outlines the procedures for completing such revisions and updates.

Five (5) Year Plan Review
The entire plan including any background studies and analysis should be reviewed every five (5) years to determine if there have been any significant changes in the region that would affect the plan. Increased development, increased exposure to certain hazards, the development of new mitigation capabilities or techniques and changes to Federal or State legislation are examples of changes that may affect the condition of the plan.

The Natural Hazard Pre-Disaster Mitigation Planning Committees, with a potential membership representing every jurisdiction in the area, will be reconstituted for the five (5) year review/update process. Typically, the same process that was used to create the original plan will be used to prepare the update.

Further, following a disaster declaration, the plan will need to be revised to reflect on lessons learned or to address specific circumstances arising out of the disaster.

The results of this five (5) year review will be summarized in the annual report prepared for this plan under the direction of the Executive Director. The annual report will include an evaluation of the effectiveness and appropriateness of the plan, and will recommend, as appropriate, any required changes or amendments to the plan.

If the Executive Director, participating jurisdictions, or Utah DESHS determines that the recommendations warrant modification to the plan, an amendment may be initiated as described below.

Plan Amendments

An amendment to the plan should be initiated by Utah DESHS, or the Executive Director, either at its own initiative or upon the recommendation of the State Hazard Mitigation Officer, Community Development Director or Mayor of an affected community.

Upon initiation of an amendment to the plan, WFRC and/ or SEUALG will forward information on the proposed amendment to all interested parties including, but not limited to, all affected city or county departments, residents and businesses. Depending on the magnitude of the amendment, the full planning committee may be reconstituted. At a minimum, the information will be made available through public notice in a newspaper of general circulation or on the SEUALG website.

Information will also be forwarded to the Utah DESHS. This information will be sent out in order to seek input on the proposed plan amendment for not less than a forty-five (45) day review and comment period.

At the end of the comment period, the proposed amendment and all review comments will be forwarded to the Community Development Director for consideration. If no comments are received from the reviewing parties within the specified review period, such will be noted accordingly. The Community Development Director will review the proposed amendment along with comments received from other parties and submit a recommendation to the Executive Director within sixty (60) days.

In determining whether to recommend approval or denial of a plan amendment request, the following factors will be considered:

1. There are errors or omissions made in the identification of issues or needs during the preparation of the plan; and/or

2. New issues or needs have been identified which were not adequately addressed in the plan; and/or

3. There has been a change in information, data or assumptions from those on which the plan was based.

4. The nature or magnitude of risks has changed.

5. There are implementation problems, such as technical, political, legal or coordination issues with other agencies.

Upon receiving the recommendation of the Executive Director or his/her designee, a public hearing will be held. The Executive Director will review the recommendation (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, the Executive Director will take one of the following actions:

1. Adopt the proposed amendment as presented.

2. Adopt the proposed amendment with modifications.

3. Defer the amendment request for further consideration and/or hearing.

4. Reject the amendment request.

Implementation and Administration through Existing Programs
Once this plan is promulgated participating cities and counties will be able to include the valuable information in this plan into existing programs and plans. These can include the General or Master Plan, Capital Improvements Plan, Emergency Operations Plan, State Mitigation Plan, City Mitigation Plans. Many of the mitigation actions developed by the cities and counties have elements of mitigation implementation including the NFIP, Fire Code, BCEGS, and CRS all of which have been implemented.

Administration will be carried out on a local level by existing and/ or new staff members dependant on the size and funding of each the projects.

Process
It will be the responsibility of Mayor/Council/Commissioner(s) of each jurisdiction, as he/she/they see fit, to ensure these actions are carried out no later than the target dates unless reasonable circumstances prevent their implementation (i.e. lack of funding availability).

Funding Sources
Although all mitigation techniques will likely save money by avoiding losses, many projects are costly to implement. The local jurisdictions will continue to seek outside funding assistance for mitigation projects in both the pre- and post-disaster environment. This portion of the plan identifies the primary Federal and State grant programs for local jurisdictions to consider, and also briefly discusses local and non-governmental funding sources.

Federal Programs
The following federal grant programs have been identified as funding sources which specifically target hazard mitigation projects:

Title: Pre-Disaster Mitigation Program
Agency: Federal Emergency Management Agency

Through the Disaster Mitigation Act of 2000, Congress approved the creation of a national program to provide a funding mechanism that is not dependent on a Presidential Disaster Declaration. The Pre-Disaster Mitigation (PDM) program provides funding to states and communities for cost-effective hazard mitigation activities that complement a comprehensive mitigation program and reduce injuries, loss of life, and damage and destruction of property.

The funding is based upon a 75% Federal share and 25% non-Federal share. The non-Federal match can be fully in-kind or cash, or a combination. Special accommodations will be made for "small and impoverished communities", who will be eligible for 90% Federal share/10% non-Federal.

FEMA provides PDM grants to states that, in turn, can provide sub-grants to local governments for accomplishing the following eligible mitigation activities:

- State and local Natural Hazard Pre-Disaster Mitigation Planning
- Technical assistance (e.g. risk assessments, project development)
- Mitigation Projects
- Acquisition or relocation of vulnerable properties
- Hazard retrofits
- Minor structural hazard control or protection projects
- Community outreach and education (up to 10% of State allocation)

Title: Flood Mitigation Assistance Program
Agency: Federal Emergency Management Agency

FEMA's Flood Mitigation Assistance program (FMA) provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings,

manufactured homes and other structures insurable under the National Flood Insurance Program (NFIP). FMA was created as part of the National Flood Insurance Reform Act of 1994 (42 USC 4101) with the goal of reducing or eliminating claims under the NFIP.

FMA is a pre-disaster grant program, and is available to states on an annual basis. This funding is available for mitigation planning and implementation of mitigation measures only, and is based upon a 75% Federal share/25% non-Federal share. States administer the FMA program and are responsible for selecting projects for funding from the applications submitted by all communities within the state. The state then forwards selected applications to FEMA for an eligibility determination. Although individuals cannot apply directly for FMA funds, their local government may submit an application on their behalf.

Title: Hazard Mitigation Grant Program
Agency: Federal Emergency Management Agency

The Hazard Mitigation Grant Program (HMGP) was created in November 1988 through Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistant Act. The HMGP assists states and local communities in implementing long-term mitigation measures following a Presidential disaster declaration.

To meet these objectives, FEMA can fund up to 75% of the eligible costs of each project. The state or local cost-share match does not need to be cash; in-kind services or materials may also be used. With the passage of the Hazard Mitigation and Relocation Assistance Act of 1993, federal funding under the HMGP is now based on 15% of the federal funds spent on the Public and Individual Assistance programs (minus administrative expenses) for each disaster.

The HMGP can be used to fund projects to protect either public or private property, so long as the projects in question fit within the state and local governments overall mitigation strategy for the disaster area, and comply with program guidelines. Examples of projects that may be funded include the acquisition or relocation of structures from hazard-prone areas, the retrofitting of existing structures to protect them from future damages; and the development of state or local standards designed to protect buildings from future damages.

Eligibility for funding under the HMGP is limited to state and local governments, certain private nonprofit organizations or institutions that serve a public function, Indian tribes and authorized tribal organizations. These organizations must apply for HMPG project funding on behalf of their citizens. In turn, applicants must work through their state, since the state is responsible for setting priorities for funding and administering the program.

Title: Public Assistance (Infrastructure) Program, Section 406
Agency: Federal Emergency Management Agency

FEMA’s Public Assistance Program, through Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, provides funding to local governments following a Presidential Disaster Declaration for mitigation measures in conjunction with the repair of damaged public facilities and infrastructure. The mitigation measures must be related to eligible disaster related damages and must directly reduce the potential for future, similar disaster damages to the eligible facility. These opportunities usually present themselves during the repair/replacement efforts.

Proposed projects must be approved by FEMA prior to funding. They will be evaluated for cost effectiveness, technical feasibility and compliance with statutory, regulatory and executive order requirements. In addition, the evaluation must ensure that the mitigation measures do not negatively impact a facility’s operation or risk from another hazard.

Public facilities are operated by state and local governments, Indian tribes or authorized tribal organizations and include:

- Roads, bridges & culverts
- Draining & irrigation channels
- Schools, city halls & other buildings
- Water, power & sanitary systems
- Airports & parks

Private nonprofit organizations are groups that own or operate facilities that provide services otherwise performed by a government agency and include, but are not limited to the following:

- Universities and other schools
- Hospitals & clinics
- Volunteer fire & ambulance
- Power cooperatives & other utilities
- Custodial care & retirement facilities
- Museums & community centers

Title: SBA Disaster Assistance Program
Agency: US Small Business Administration

The SBA Disaster Assistance Program provides low-interest loans to businesses following a Presidential disaster declaration. The loans target businesses to repair or replace uninsured disaster damages to property owned by the business, including real estate, machinery and equipment, inventory and supplies. Businesses of any size are eligible, along with non-profit organizations.

SBA loans can be utilized by their recipients to incorporate mitigation techniques into the repair and restoration of their business.

Title: Community Development Block Grants
Agency: US Department of Housing and Urban Development

The Community Development Block Grant (CDBG) program provides grants to local governments for community and economic development projects that primarily benefit low- and moderate-income people. The CDBG program also provides grants for post-disaster hazard mitigation and recovery following a Presidential disaster declaration. Funds can be used for activities such as acquisition, rehabilitation or reconstruction of damaged properties and facilities and for the redevelopment of disaster areas.

State Programs
The state of Utah maintains a philosophy of local responsibility for hazard mitigation. State agencies still provide an integrated network of support, services, and resources for hazard mitigation activities. As demonstrated during past disasters, these agencies are well organized in their delivery and coordination of services. The following is a review of State departments with disaster responsibilities describing their existing and planned mitigation programs.

An evaluation of the laws, regulations, authorities, policies, and programs used in Utah to mitigate hazards demonstrate that they work exceptionally well, as evidenced by the massive amount of mitigation accomplished in Utah, the few numbers of disasters, and the limited nature of those emergencies that do occur. According to the Utah SHMT, the only changes that could be considered by the Legislature might be ones that parallel the Federal Disaster Mitigation Act of 2000, which would integrate pre-disaster mitigation considerations into the code of various state agencies.

Utah Division of Emergency Services and Homeland Security (DESHS)
The capabilities of DESHS Hazard Mitigation Program include:

- Prepare, implement, and maintain programs and plans to provide for preventions and minimization of injury and damage caused by disasters.
- Identify areas particularly vulnerable to disasters.
- Coordinate hazard mitigation and other preventive and preparedness measures designed to eliminate or reduce disasters.
- Assist local officials in designing local emergency actions plans.
- Coordinate federal, state, and local emergency activities.
- Coordinate emergency operations plans with emergency pans of the federal governments.

Through the State Hazard Mitigation Program, the following occurs:

- Provides a state coordinator for hazard mitigation, the State Hazard Mitigation Officer.
- Provides a central location of the coordination of state hazard mitigation activities.
- Provides coordination for the Federal Pre-Disaster Mitigation Program.
- Provide for coordination of Project Impact.
- Provide coordination for Comprehensive Multi-hazard Mitigation Plan development, implementation, and monitoring.
- Provide for interagency coordination
- Provide development of procedures for grant administration and project evaluation.
- Provide State Hazard Mitigation Team assistance to local governments.
- Provide for development of specific hazard mitigation plans, such as drought and wildfire.
- Provide for local hazard and risk analysis.
- Provide for development of SHMT mitigation recommendations following disasters.

Utah Department of Agriculture
The Utah Department of Agriculture administers programs serving the state's large agricultural sector. The department's response role during and after a disaster period has been to coordinate damage reports for funding needs and provides loan and recovery program information and assistance to disaster victims. This service is provided for flood, drought, insect infestation, fire, livestock disease, and frost.

Assistance During Drought Disasters
A damage reporting network coordinated through the existing County Emergency Board was established during the drought disaster of 1996. Each county agent assembled damage reports in his area and transmitted them through a computer network based at Utah State University. The individual damage reports from each county were recapped in the Department of Agriculture and formed the basis of documentation for an appeal to the legislature for additional funds to mitigate the damage.

Loans Handbook
The department has prepared a handbook listing the types of loans available for flood damage to agriculture, the funding requirements, and applications procedures. This includes loans from both state and federal sources. There are three loan programs operated by the agriculture department, all of which can be used for flood damage:

1) Rural Rehabilitation Loan Program (federally funded and operated by the state)
2) Agriculture Resource Development Loan Program (state funded)
3) Emergency Loan Program (state funded)

Soil Conservation Program
The Department of Agriculture also administers the ongoing Soil Conservation Program. In each of the state's thirty-nine soil conservation districts, three unpaid, elected supervisors offer technical assistance and consultation on watershed protection. The state offers limited technical and planning assistance through a staff member. The program works cooperatively with the federal Soil Conservation Service, which provides most of the technical assistance. The ongoing program is not regulatory, but is directed towards improved water use and soil conservation.

Disaster Easements
Because of the similarity between past events, the department is now working on a permanent hazard mitigation concept known as "Disaster Easements", which may have widespread agreements with irrigation companies, water districts, or water users' associations for the purpose of routing flood water through local communities.

Monitoring Ground Water Quality
The Department also monitors the quality of groundwater, including individual wells and springs throughout the State.

Non-Point Source Pollution
The Department's Non-Point Source Pollution Program focuses on flood prevention through reduction of erosion, vegetating streams, and restoring "natural stream structure". The Department also monitors drought conditions, which are a precursor to wildfire.

Department of Community and Economic Development

Community Impact Board
The Utah Permanent Community Impact Fund Board provides loans and/or grants to state agencies and sub-divisions of the state, which may be socially or economically impacted by mineral resource development of federal lands.

Permanent Community Impact Fund
The Permanent Community Impact Fund provides loans and/or grants to state agencies and subdivisions of the state, which are or may be socially or economically impacted, directly or indirectly, by mineral resource development on federal lands.

Under the Federal Mineral Lease Act of 1920, leaseholders on public land make royalty payments to the federal government for the development and production of non-metalliferous minerals. In Utah, the primary source of these royalties is the commercial production of fossil fuels on federal land held by the U.S. Forest Service and the Bureau of Land Management. Since the enactment of the Minerals Lease Act of 1920, a portion of these royalty payments, called mineral lease payments, have been returned to the state in an effort to help mitigate the local impact of energy and mineral developments on federal lands.

Funding Options
The Board has the option of funding projects with loans and/or grants. The Board's preferred financing mechanism is an interest-bearing loan.

Loan Requirements

In providing financial assistance in the form of a loan, the Board may purchase an applicant's bonds only if the bonds are accompanied by legal opinion of recognized municipal bond counsel to the effect that the bonds are legal and binding under applicable Utah Law.

The Board may purchase either a taxable or tax-exempt bond. The board may purchase taxable bonds if it determines, after evaluating all relevant circumstances, including the applicant's ability to pay, that the purchase of the taxable bonds is in the best interest of the state and the applicant.

Grants

Grants may be provided only when the other financing mechanisms cannot be utilized, where no reasonable method of repayment can be identified, or in emergency situations regarding public health and/or safety.

Community Development Block Grant

The Community Development Block Grant, or CDBG program, provides funding from the federal government's Department of Housing and Urban Development or HUD, to small cities and counties in the State of Utah.

Utah Division of State History

The Utah State Historical Society, Utah's Division of State History, was founded in 1897 on the 50th anniversary of the first settlement in the Salt Lake Valley by the Mormon Pioneers. The Society became a state agency in 1917, now housed in the historic Rio Grande Depot since 1980. The Division stimulates archaeological research, study; oversees the protection and orderly development of sites; collects and preserves specimens; administers site surveys; keeps excavation records; encourage and supports the preservation of historic and pre-historic sites and publishes antiquities records. The Division also issues archaeological permits and consults with agencies and individuals doing archaeological work.

Preserving and Sharing Utah's Past

The mission of the State Division of History is "preserving and sharing Utah's past for the present and the future".

State Historical Preservation Officer (SHPO)

The SHPO administers the Section 106 process (national Historic Preservation Act) in Utah. The SHPO also serves on the Utah State Hazard Mitigation Team, providing guidance on historical and cultural preservation regulations.

Historic properties include districts, buildings, structures, objects, landscapes, archeological sites, and traditional cultural properties that are included in, or eligible for inclusion in, the National Register of Historic Places. These properties are not just "old buildings" or "well-known historic sites, but places important in local, state, or national history. Facilities as diverse as bridges and water treatment plants my, be considered historic.

Utah Geological Survey (UGS)

The Utah Geologic and Mineral Survey is the principal state agency concerned with geologic hazards. Through years of study, the UGS has developed considerable information on Utah's geologic hazards. When geologic events occur or threaten to occur, the UGS is consulted by other state agencies, local governments, and private organizations for assistance in defining the threat from natural hazards. The UGS works in partnership with other agencies, such as DESHS, in relating the threats from natural hazard to the communities at risk.

Functions

The functions of the UGS include the following:

- Evaluation of individual geological hazards;
- Participation on local government and state agency technical teams;
- Prediction of the performance on individual slides once they began to move;
- Coordination and awareness of research efforts undertaken by other agencies;
- Provide information on status of individual geologic hazards;
- Reconnaissance reports on status of hazards statewide;
- Advise Division of Water Rights on geologic hazards associated with dam sites; and
- Provide geologic information for use during planning of remedial actions.

Laws/authorities/policies of the Utah Geological Survey for conducting mitigation

Utah Code Annotated
Chapter 73 Geological and Mineral Survey
Section 68-73-6 Objectives of Survey
(1) Determine and investigate areas of geologic and topographic hazards that could affect the safety of, or cause economic loss to, the citizens of this state; (f) assist local and state government agencies in their planning, zoning, and building regulations functions by publishing maps, delineating appropriately wide special earthquake risk areas, and, at the request of state agencies, review the citing of critical facilities:

Utah State Office of Education (USOE) Rule R277-455 Standards and Procedures for building plan review

R277-455-4 Criteria for Approval; to receive approval of a proposed building site, the local school district must certify that:

Staff of the Utah Geologic Survey have reviewed and recommended approval of the geologic hazards report provided by the school districts geo-technical consultant.

Division of Water Resources
The Divisions role of planning, funding and constructing water projects serves as both active and passive hazard mitigation against drought and flood situations throughout the state. The various State water plans contain brief summaries of flood threat and risk for each drainages.

The Division is one of seven agencies in the State Department of Natural Resources. The eight member Water Resources Board, appointed by the governor, administers three state water conservation and development funds. These include:

- Revolving Construction fund – This fund started in 1947 with 1 million legislative appropriation to help construct irrigation projects, wells and rural culinary water systems. Further appropriations have added to this fund.
- Conservation and Development Fund – This fund was created in 1978 wit the sale of 25 million in general obligations bonds. Money was added to this fund with bond sales in 1980 and 1983. The C & D Fund generally helps sponsors finance larger multi-purpose dams and water systems.
- Cities Water Loan Fund – Established with an initial legislative appropriation of 2 million dollars in 1974, and with continued appropriations, this fund provides financing to help construct new culinary water projects for cities, towns, improvement districts, and special service districts.

Construction Funds
In addition to overseeing these three construction funds, the Division also manages the State funds appropriated each year for renovation and reconstruction of unsafe dams. As the funding arm of the state for water resource projects the Division works closely with Water Rights, the Regulatory arm of the state charged with jurisdiction over all private and state owned dams.

Water Resource Planning

The Division is also charged with the general water resource planning for the state. The State Water Plan is a process that is coordinated to evaluate existing water resources in the state, determine water-related issues that should be confronted and recommend how and by whom issues can be resolved. The plan identifies programs and practices of state and federal agencies, water user groups and environmental interests and describes the state's current, future, and long-term water related needs. The plan is continually updated using current hydrologic databases, river basin simulations, water supply and demand models and water related land use inventories. Revisions reflect the latest water conservation and development options concerning water rights, water transfers, population, zoning, and many other complex issues for the next 50 years in the state's major river basins.

Utah Division of Forestry, Fire, and State Lands

The Division of Forestry, Fire & State Lands utilizes the principles of stewardship and ecosystem management to assist non-federal landowners in management of their natural resources. The agency provides wildland fire protection for non-federal landowners commensurate with risk; and optimizes the benefits from ecosystem based, multiple-use management of resources held in the public trust. Wildfires are managed from six area offices 1) Bear River Office, 2) Northeast Area, 3)Wasatch Front Area, 4) Central Area, 5) Southwest Area, and 5) Southeast Area. The Division operates under the authority of the Utah Code Annotated 65-A-3-1 though 10.

The Flame-n-Go's (pronounced Flamingoes)

In 1978 the Division of Forestry, Fire, and State Lands and the Utah State Prison signed a cooperative agreement establishing Utah's first volunteer, inmate wildland fire hand-crew. The inmates named themselves the "Flame-N-Go's" and designed a logo that has become well known in the wildland fire fighting community.

All Flame-N-Go's are carefully screened for the program. They must complete rigorous training and sign a yearly contract committing themselves to preserving Utah's natural resources and building responsible lives.

The Flame-N-Go's are divided into three crews, each of which can respond to fires anywhere in the United States. A twenty-man type II hand line crew is the backbone of the group, responding to each assignment with all tools and equipment needed to do battle on the fire line. An Engine Strike Team, (five fire engines, outfitted with men and equipment) is ready to respond when needed as an Engine Strike Team or a Type II Hand line Crew. The Hotshot crew is trained to tackle the most dangerous fires in the most rugged terrain. All crews during peak fire season are on 24-hour call to respond within an hour's notice. These crews respond to an average of 50 fires per year and typically spend 45,000 hours fighting fires each season. At least one Division of Forestry, Fire, and State Lands supervisor and two Department of Corrections staff accompany each crew.

Each year, Flame-N-Go's are put through at least 80 hours of extensive training including classroom work and practical field exercises. Safety, individual, and team skills, and professionalism are stressed.

National Fire Plan

The Division administers the State responsibilities of the National fire Plan, a current emphasis of the U.S. Congress, which also addresses hazard and risk analysis and hazard mitigation.

Living With Fire Committee

The Division works in partnership with the U.S. Forest Service, Bureau of Land Management, and various other entities tasked with suppressing wildland fires on the "Living With Fire" program promoting wildland fire mitigation.

Utah Division of State Parks and Recreation
The goal of the Division of Parks and Recreation is to enhance the quality of life for residents and visitors of our state through parks, people, and programs. They are responsible for protecting, preserving, and managing many of Utah's natural and heritage resources.

Hazard and Risk Analyses
The Division develops hazard and risk analyses for the State Parks as part of the park resource management plans. The Utah Division of Emergency Services and Homeland Security produced one analysis for Snow Canyon State Park in Washington County.

Non-Motorized Trail Program
The Recreational Trails Act of 1991 charged Utah State Parks and Recreation with coordinating the development of a statewide network of non-motorized trails. The Non-Motorized Trail program makes state and federal funds available on a 50/50 matching basis to any federal, state, or local government agency, or special improvement district for the planning, acquisition, and development of recreational trails.

Grants from State Parks Boards
The council advises the Division of Parks and Recreation on non-motorized trail matters, reviews requests for matching grant fiscal assistance, rates and ranks proposed trail projects and along with State Park's staff provides recommendations for funding to the State Parks Board.

Riverway Enhancement Program
In 1986, the Utah Legislature passed a bill, which established the Riverway Enhancement Program. The program makes state funds available on a 50/50 matching basis to state agencies, counties, cities, towns, and/or special improvement districts for property acquisition and/or development for recreation, flood control, conservation, and wildlife management, along rivers and streams that are impacted by high density populations or are prone to flooding. Public outdoor recreation should be the primary focus of the project.

Utah Division of Water Rights
The Division of Water Rights is the state agency that regulated appropriation and distribution of water in the State of Utah. It is an office of public record. The Utah State Engineer's Office was created in 1897. The State Engineer's Office is the chief water rights administrative officer. A complete "water code" was enacted in 1903 and was revised and reenacted in 1919. This law, with succeeding complete reenactments of State statutes, and as amended, is presently in force mostly as *Utah Code, Title 73*. In 1963, the name was changed from State Engineers office to the Division of Water Rights.

All water in Utah are public property. A water right is a right to the use of water based upon 1) quantity, 2) source, 3) priority date, 4) nature of use, 5) point of diversion, and 6) physically putting water to beneficial use.

Regulate Dams
The State engineer has the authority to regulate dams for the purpose of protecting public safety. Dams are classified according to hazard, size, and use. The dam inventory gives the identification, location, construction parameters, and the operation and maintenance history of the dams in Utah.

Stream Alterations Program
The Utah State Engineer's Office administers a Stream alterations program with the purpose of regulation activities affecting the bed or banks or natural streams. The State Engineer's working definition of a natural stream is any natural waterway in the state, which has flows of sufficient duration to develop a characteristic ecosystem distinguishing it from the surrounding environments. Any individual planning an activity that will affect a natural stream must first obtain a Stream Alterations Permit from this office.

Most proposals reviewed by the State, are covered by General Permit 40, which authorizes the state to have its Stream Alteration Permit fulfill the requirements of Section 404 of the Clean Water Act for most activities. General permit 40 does not apply in some instances and a U.S. Army Corps of Engineers Individual Permit is required. Projects requiring this additional permit include those involving wetlands, threatened or endangered species, properties listed on the National Historic Register, stream relocation, or the pushing of streambed material against a stream bank.

Dam Safety Program

The Dam Safety Section of the Division of Water Rights was established under Chapters 73-5a 101 thru 73-5a 702 including chapters 73-2-22 for Flood Control and the Chapter 63-30-10 Waiver of Immunity of the Utah Code and Rules R655-10 thru R655-12-6A. The program basically has jurisdiction over all private and state owned dams in the state during design, construction, operation, and decommissioning. This involved periodic inspections according to hazard classifications, inventory maintenance, design, and construction approval and systematic upgrade of all the high hazard structures to current dam safety Minimum Standards and creation of Emergency Action Plans for High Hazard dams. Since 1991, detailed dam reviews have been undertaken by the staff and by private consulting firms. Since 1995, the State Legislature has provided 3-4 million dollars per year to finance 50 % of the instrumentation, investigations, and design and 80 to 90 % of the construction costs of retrofitting and upgrading deficient dams, starting with the worst dams in the most hazardous locations.

The impetus for this dam safety program has been in reaction to dam failures, both in Utah and in other states, including the Teton Dam in Idaho and the Trial Lake Dam in Summit County and the Quail Creek Dam near St. George Utah. Since the establishment of our Minimum Standards program we have fostered the repair of dozens of dams and have not had a catastrophic failure since.

Future recommendations include continuation of the funding for dam upgrades for all the high hazard dams, and then the moderate hazard dams, continued annual inspections for maintenance items and dangerous deficiencies, upgrading EAP, and hazard assessment to reflect downstream development. Inclusion of the scanned design drawings and inundation maps from the EAP studies is being considered for our web page for public information and emergency access. Possible expansion of the program to cover canals and dikes has been considered.

Utah Division of Wildlife Resources

It is the mission of the Utah Division of Wildlife Resources to serve people of Utah as trustee and guardian of the State's wildlife. Regulates hunting, fishing and trapping, and promotes recreational, educational, scientific and aesthetic enjoyment of wildlife.

Wildlife Habitats and Hazards

Wildlife species and/or their habitats are frequently exposed to hazards. These may be either natural or human influenced (i.e. drought, flood, fire, wind, snow, wetland drainage, water diversions, hazardous material spills, improper/illegal chemical use, earthquake, and other land or water construction/development). Impact resulting either directly or indirectly, from individuals or an accumulation of several hazards, may cause but not be limited to: decreased water supply, stream/lake channel/basin morphology change, riparian/upland vegetation loss or degradation, and impairment of water quality. These in turn have a varying influence, in the extreme causing death or at a minimum temporary stress, on wildlife populations and their habitats. Hazards mentioned may affect a fairly large geographic area or be very localized in nature.

While the Division of Wildlife Resources (DNR) is charged with the management of wildlife, they do not have regulatory authority over water appropriations, water quality, development, or land management; except as allowed or occurring on properties they own. Therefore, when hazards occur, outside DWR property, DWR is limited to be a participating influence only through comments to the other regulatory agencies or individuals.

DWR management of wildlife is carried out largely through regulation of taking controlling, disturbance and/or possession of wildlife, and introduction of movement of species. However, there are numerous non-regulatory means (i.e. conservation agreements, memorandum of understanding, contract, lease agreements, cooperative agreements, and technical assistance) by which DWR interacts with other agencies, groups and individuals, to have an influence on wildlife and/or their habitat.

Hazard Areas of Commentary Interaction

While not being able to control/regulate many of the elements necessary for the benefit of wildlife; DWR provides technical comments for the maintenance, protection, and enhancement of wildlife and/or habitats for various value reasons. It is too extensive list all the areas of comment; however, the following are examples of fairly frequent concern:

- Steam Channel Alteration Permit Applications
- Water Rights Filings
- Energy and Mineral Exploration and Extraction Applications
- Federal Agency land management plans
- Waste Water Discharge Permit Applications
- Hydroelectric plant licensing or regimenting
- Urban and rural development project planning
- Utility transmission line style and locations
- Wetland alteration
- Federal land management planning
- Highway constructions

The Utah Division of Drinking Water

Division of Drinking Water's Mission Statement is to " protect the public against waterborne heath risks through assistance, educations, and oversight". The Division acts as the administrative arm of the Utah Drinking Water Board. It implements the rules, which they adopt. As such, it is engaged in a variety of activities related to the design and operation of Utah's public drinking water system. The Utah Drinking Water Board is an 11-person board appointed by the Governor. It is empowered by Title 19, Chapter 4 of the Utah Code to adopt rules governing the design, operations, and maintenance of Utah's "public drinking water system".

Safe Drinking Water Act

There is a Federal Safe Drinking Water Act, which applies to all public drinking water systems in the country. The U.S. Environmental Protection Agency (EPA) has given Utah "primacy" for enforcing the federal act within its boundaries. To qualify for this Utah's laws and rules governing public drinking water systems must be at least as strict as the federal law.

Sanitary Surveys

The Division performs sanitary surveys on the water systems, which is a compliance action that identifies system deficiencies.

Emergency Response Plans

The Division of Drinking Water requires water utilities to prepare emergency response plans under the State Safe Drinking Water Act, Utah Code Section 19-4. The Division operates according to DDW Rules: R309 gives them authority to administer actions: R309-301 through R309-104 and R309-113, R309-150, R309-301, and R309-211.

Utah Division of Solid and Hazardous Waste

The Tier II Chemical Inventory report, required by the Federal Emergency Planning and community Right-to-Know Act, requires facilities to submit lists of hazardous chemicals present on site. These reports are computerized and the information is provided to local emergency planning committees, the general public, and others for contingency planning purposes. To implement the Federal law, the State operates under Utah State Code, Section 63-5-5. The Division of Solid and Hazardous Waste requires that hazardous waste

treatment storage and disposal facilities prepare and emergency response plan as required by regulations authorized by the State Solid and Hazardous Waste Act, Utah Code Section 19-6.

Other Agency programs are regulatory in nature requiring proper use or disposal of hazardous substances or pollutants. For example the Division of Solid and Hazardous Waste regulates the disposal of hazardous waste, the Division of Radiation Control regulates the proper usage and disposal of radioactive materials. As such there is a threat mitigation nature to these programs.

Utah Division of Water Quality
The Utah Division of Water Quality protects, maintains, and enhances the quality of Utah's surface and underground water for appropriate beneficial uses; the Division of Water Quality regulates discharge of pollutants into surface water, and protects the public health through eliminating and preventing water related health hazards which can occur as a result of improper disposal of human, animal, or industrial wastes while giving reasonable consideration to the economic impact.

Water Quality Fund and Wastewater Treatment Project Fund: The Division Manages the Water Quality Revolving Fund that can be used by local governments for water quality projects and a Wastewater Treatment Project Fund.

Abating Watershed Pollution: Federal and State regulations charge the Division with "preventing, controlling, and abating" watershed pollution. Other state and local agencies have similar responsibilities. The Watershed Approach forms partnerships with these groups to pool resources and increase the effectiveness of existing programs. For each watershed management unit, a watershed plan will be prepared. The watershed plan addresses management actions at several spatial scales ranging from those that encompass a watershed management unit to specific sites that are tailored to specific environmental conditions. Ground water hydrologic basins and eco-region areas encompassed within the units will also be delineated.

State Revolving Fund Program
In 1987, Congress replaced the Construction Grants Program, with the State Revolving Fund Program. Rather than provide direct grants to communities, the federal government provides each state with a series of grants, then each state contributes a 20 percent state match. Grants from the federal government are combined with state funds in the Water Quality Project Assistance Program (WQPAP) and are used to capitalize a perpetual source of funds to finance water quality construction control activities at below market interests rates. Projects eligible for WQPAP financing include such traditional activities as construction of wastewater treatment plants and sewers. The program also will finance non-traditional water quality-related activities such as agricultural runoff control, landfill closures, contaminated industrial property (Brownfield) remediation, stream bank restoration, and wellhead protection.

Local
Local governments depend upon local property taxes as their primary source of revenue. These taxes are typically used to finance services that must be available and delivered on a routine and regular basis to the general public. If local budgets allow, these funds are used to match Federal or State grant programs when required for large-scale projects.

Non-Governmental
Another potential source of revenue for implementing local mitigation projects are monetary contributions from non-governmental organizations, such as private sector companies, churches, charities, community relief funds, the Red Cross, hospitals, Land Trusts and other non-profit organizations.

Paramount to having a plan deemed to be valid is its implementation. There is currently no new fiscal note attached to the implementation of this plan.

Continued Public Involvement
Throughout the planning process, public involvement has been and will be critical to the development of the Plan and its updates. The plan will be available on the SEUALG and Utah DESHS website's to provide opportunities for public participation and comment. The plan will also be available for review at the offices of the Wasatch Front Regional Council and/ or Southeastern Utah Association of Local Governments.

The Wasatch Front Regional Council has been designated as the lead agency in preparing and submitting the Southeastern Utah Association of Local Governments Natural Hazard Pre-Disaster Mitigation Plan, which includes coverage for all incorporated cities and counties within the four county region, i.e. Carbon, Emery, Grand, and San Juan Counties. The strategy of the Association of Governments in preparing the plan is to use available resources and manpower in the most efficient and cost effective manner to allow our cities and counties continued access to data, technical planning assistance and FEMA eligibility. In addition, the AOG will reach out to non-profits, public agencies, special needs organizations, groups and individuals in allowing them input and access to the plan. With limited resources, however, it becomes difficult to both identify and to individually contact the broad range of potential clients that may stand to benefit from the plan. This being the case, we have established the following course of action:

STEP 1. The AOG will publicly advertise all hearings, requests for input and meetings directly related to the Natural Hazard Pre-Disaster Mitigation Planning process. Meetings of the regional council where plan items are discussed and where actions are taken will not receive special notifications as they are already advertised according to set standards. All interested parties are welcome and invited to attend such meetings and hearings, as they are public and open to all. Advertisement will be done according to the pattern set in previous years, i.e. the AOG will advertise each hearing and request for input at least seven days (7) in advance of the activity and will publish notices of the event in the local newspapers. The notices will advertise both the hearing and the means of providing input outside the hearing if an interested person is unable to attend.

STEP 2. The AOG has established a mailing list of many local agencies and individuals that may have an interest in the Natural Hazard Pre-Disaster Mitigation Plan. Each identified agency or person will be mailed a notice of the hearings and open houses.

STEP 3. Comments, both oral and written, will be solicited and accepted from any interested party. Comments, as far as possible, will be included in the final draft of the plan; however, the AOG reserves the right to limit comments that are excessively long due to the size of the plan.

STEP 4. Specific to risk assessment and hazard mitigation, needs analysis, and capital investment strategies, the AOG will make initial contact and solicitation for input from each incorporated jurisdiction within the region. All input is voluntary. Staff time and resources do not allow personal contact with other agencies or groups, however, comments and strategies are welcomed as input to the planning process from any party via regular mail, FAX, e-mail, phone call, etc. In addition, every public jurisdiction advertises and conducts public hearings on their planning, budget, etc. where most of these mitigation projects are initiated. Input can be received from these prime sources by the region as well.

STEP 5. The final draft of the Natural Hazard Pre-Disaster Mitigation Plan will be presented to the SEUALG Executive Director for adoption and approval to submit the document to State authorities. SEUALG policies on adoption or approval of items will be in force and adhered to. This document is intended to be flexible and in constant change so comments can be taken at any time of the year for consideration and inclusion in the next update. Additionally, after FEMA approval of the plan, the plan will be promulgated for each local jurisdiction for adoption by resolution.

STEP 6. The following policies will guide AOG staff in making access and input to the Natural Hazard Pre-Disaster Mitigation Plan as open and convenient as possible:

A. Participation:

All citizens of the region are encouraged to participate in the planning process, especially those who may reside within identified hazard areas. The AOG will take whatever actions possible to accommodate special needs of individuals including the impaired, non-English speaking, persons of limited mobility, etc.

B. Access to Meetings:
Adequate and timely notification to all area residents will be given as outlined above to all hearings, forums, and meetings.

C. Access to Information:
Citizens, public jurisdictions, agencies and other interested parties will have the opportunity to receive information and submit comments on any aspect of the Natural Hazard Pre-Disaster Mitigation Plan, and/or any other documents prepared for distribution by the AOGs that may be adopted as part of the plan by reference. The AOG may charge a nominal fee for printing of documents that are longer than three pages.

D. Technical Assistance:
Residents as well as local jurisdictions may request assistance in accessing the program and interpretation of mitigation projects. AOG staff will assist to the extent practical, however, limited staff time and resources may prohibit staff from giving all the assistance requested. The AOG will be the sole determiner of the amount of assistance given all requests.

E. Public Hearings:
The AOG will plan and hold public hearings according to the following priorities:

1. Hearings will be conveniently timed for people who might benefit most from mitigation programs.
2. Hearings will be accessible to people with disabilities (accommodations must be requested in advance according to previously established policy).
3. Hearings will be adequately publicized. Hearings may be held for a number of purposes or functions including to: Identify and profile hazards, Develop mitigation strategies, and Review plan goals, performance, and future plans.

F. Future Revisions:
Future revisions of the plan shall include:

1. Expanded vulnerability assessments to include flood and dam failure inundation.
2. Continue the search for more specific mitigation actions.
3. An analysis of progress of the plan as it is revised.
4. Expanded look into how the identified natural hazards will affect certain populations including the young and elderly.